THE INDEPENDENT GUIDE TO PERSONAL COMPUTING SEPTEMBER 12, 1995 VOL. 14 NO. 15 U.S. $3.95 / CAN. $4.95 / U.K. £2.95 ZD

PC MAGAZINE

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THE COMPLETE

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Computer Reseller News

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Inside

With Windows 95 and Intel P6 systems on the horizon, it's clear we're entering another season in the computer industry.

At *PC Magazine* the season is changing as well. This issue marks a change in editors for us. Robin Raskin, who has been responsible for the day-to-day operations of the editorial side of the magazine for the past 18 months, is leaving us to head up our sister publication, *FamilyPC,* a joint venture between Ziff-Davis and The Walt Disney Co.

Robin started out writing for *PC Magazine* almost ten years ago and came on staff five years ago to direct our First Looks coverage. During this period, she has become one of the leading experts on family use of computers and has written two books on the subject.

Departing editor Robin Raskin hands *PC Magazine* over to Jake Kirchner.

We know that she'll do a wonderful job at *FamilyPC.* Moreover, she won't be too far away; you can expect to continue seeing her byline in these pages from time to time.

Stepping into her position at *PC Magazine* is Jake Kirchner, our new editor. Jake, a 20-year veteran of computer journalism, comes to *PC Magazine* from *Communications Week,* where he was editor-in-chief. Previously executive editor of *Windows Magazine* and chief editor of *Government Computer News,* Jake also has held senior editorial positions at several other computer publications.

Jake has already begun to take over Robin's day-to-day management responsibilities and will begin writing the Pipeline column in the next issue.

Jake says, "I am very happy to be with the leading publication in the business. We plan to continue our tradition of providing the most in-depth evaluation of computer hardware, software, and networking products. With the advent of Windows 95 and the next-generation Intel microprocessor, I couldn't ask for a more exciting time to join *PC Magazine.*"

I'm looking forward to working with Jake and the rest of the *PC Magazine* team in covering the new products that are coming in this and many more computer seasons.—*Michael J. Miller*

PC Magazine: The Independent Guide to Personal Computing, ISSN 0888-8507, is published biweekly except in July and August, for $49.97 for one year. Ziff-Davis Publishing Company, L.P., One Park Ave., New York, NY 10016-5802. Second-class postage paid at New York, NY 10016-5802 and at additional mailing offices. POSTMASTER: Address changes to ***PC Magazine,*** P.O. Box 54093, Boulder, CO 80322-4093. GST Registration Number: R-123669673. Canada Post International Publications Mail Product (Canadian Distribution) Sales Agreement No. 266477.

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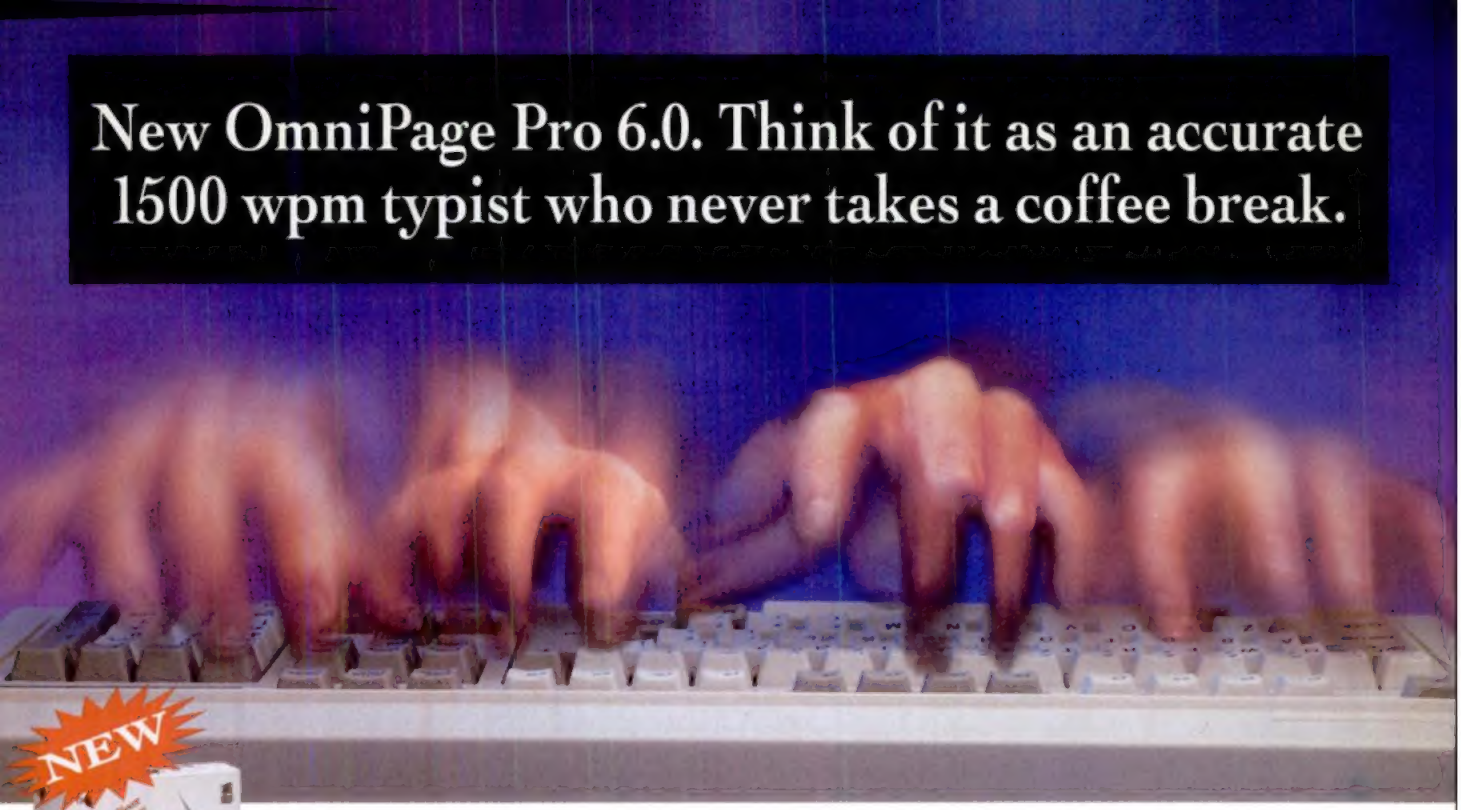

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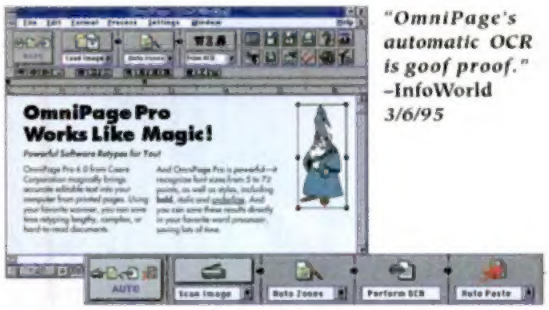

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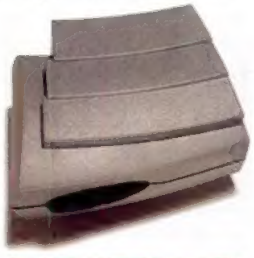

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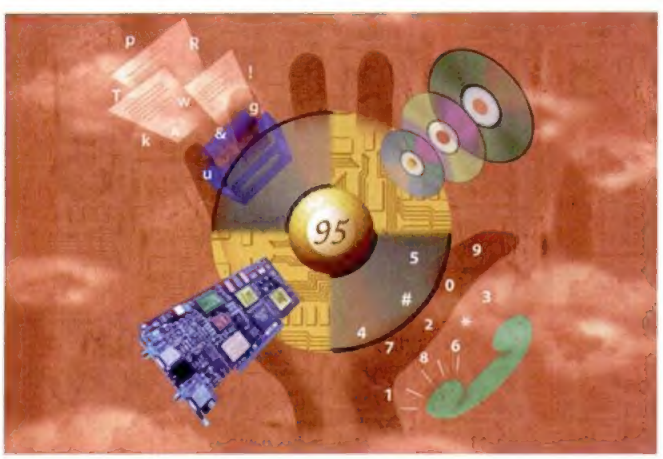

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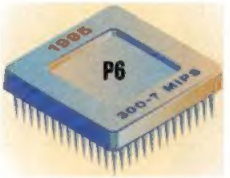

BY SEBASTIAN RUPLEY AND JOHN CLYMAN

Intel's next-generation P6 processor is built for speed. But there's a catch: To exploit its aggressive design, you need 32-bit applications and a 32-bit operating system such as Windows NT. Otherwise, performance gains will be minimal; with existing 16-bit applications and Windows 3.1, P6 systems may actually run slower than Pentium machines. We take a long, hard look at the prospects for the successor to the Pentium ..**102**

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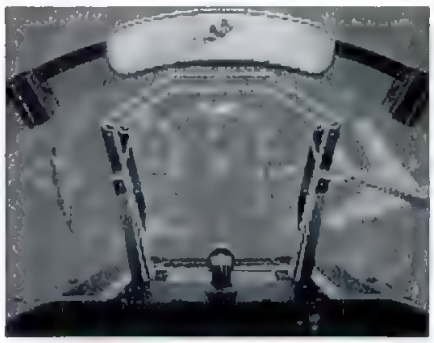

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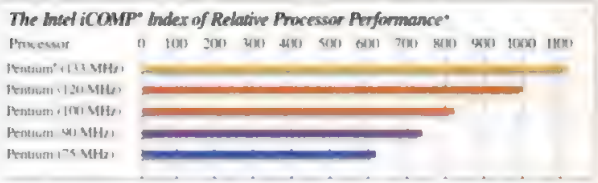

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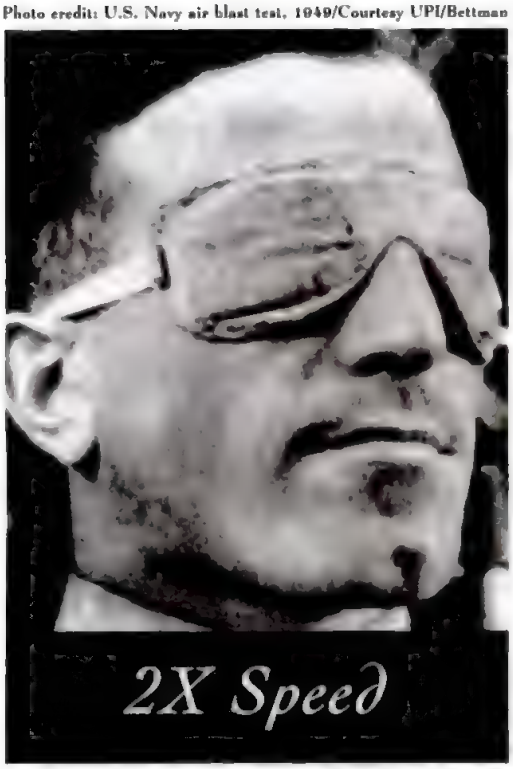

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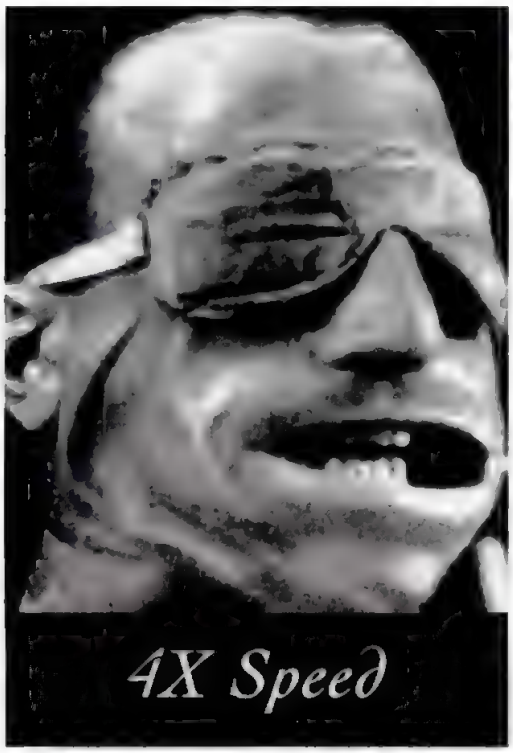

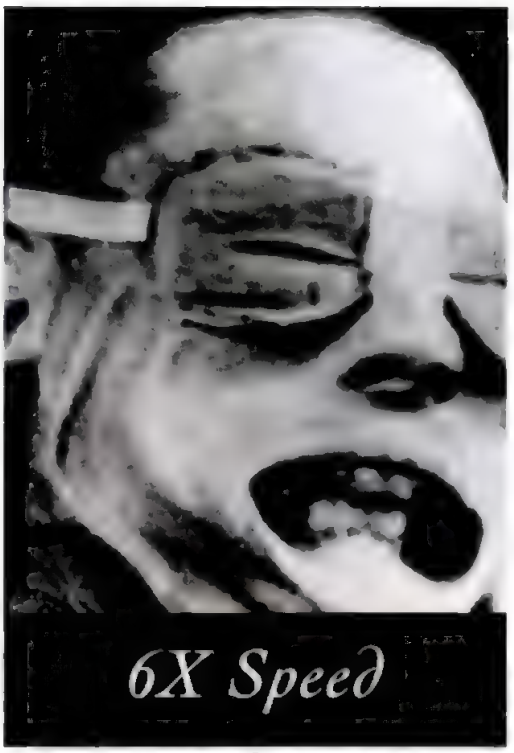

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CIRCLE 157 ON READER SERVICE CARD

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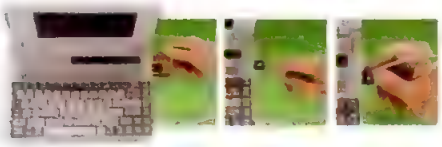

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CIRCLE 321 ON READER SERVICE CARD

Letters

LOOKING THROUGH WINDOWS 95

Our preview of Microsoft Windows 95 ("Getting Ready for Windows 95," May 16, 1995) prompted a large response from readers, many of whom were using either the Windows 95 Preview Program or the beta and wished to weigh in with their impressions.

Having read every Windows 95 article I could get my hands on, I found your story to be the most in-depth, unbiased review I've seen. Congratulations for presenting Windows 95's strengths as well as its weaknesses.

BOB STABER, *via PC MagNet*

Your story was the most comprehensive article on Windows 95 I've seen so far. It was clear, thorough, and impartial. And there was a good deal of coverage included on Windows NT and OS/2 Warp, which makes it easier to understand which system best fits one's needs.

ROLANDO NATALIZIA, *Asuncion, Paraguay*

When I first saw the Windows 95 cover story, I instinctively groaned. But when I read the article, I found it to be a very well-balanced piece, one that didn't simply mimic the hype, but instead pointed out both the negative and the positive aspects of the operating system. Your independence and fairness reminded me why I remain a subscriber of *PC Magazine*.

DON J. JEHLE, *Jellico, Tennessee*

I really enjoyed your coverage of Windows 95. It was very informative, very complete, and generally well balanced. Your coverage of the operating-system architectures was just at the right level—not overly detailed, enlightening, and fascinating.

RICHARD ENG, *via the Internet*

Although I'm a die-hard OS/2 user, I found your superior preview of Windows 95 very informative and unbiased. I learned not only more about OS/2, but about operating systems in general. Your coverage of Windows 95 and its competitors reinforced the fact that any operating system one chooses will take time to tweak, learn, and configure.

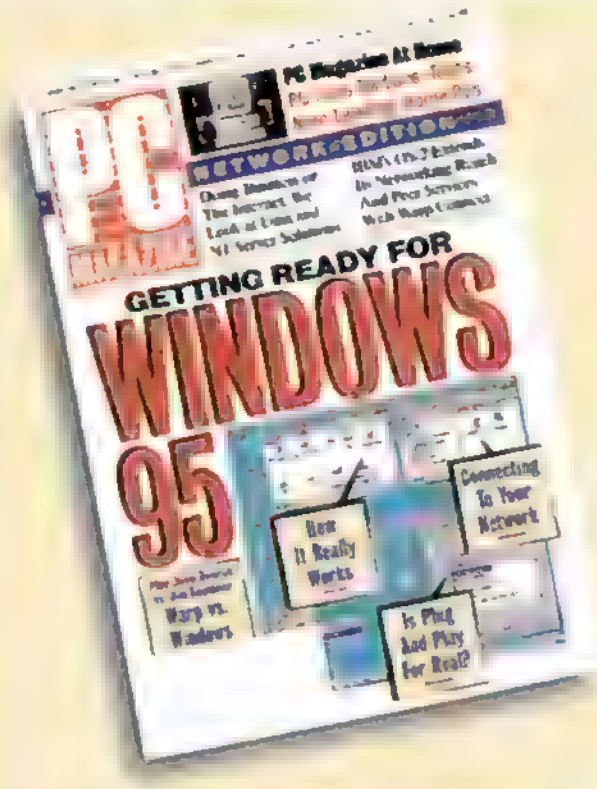
MATTHEW BEALL, *via the Internet*

Your Windows 95 article neglected to mention the things Microsoft forgot to include. Clearly Microsoft has made leaps and bounds with its impressive new system. But if the final beta is any indication of what we should expect, then Windows 95 is also still lacking.

DAVE BERRY, *via PC MagNet*

I appreciate your recent articles on Windows 95 and the comparison of OS/2 and Windows NT that accompanied these reviews. I'm an OS/2 Warp user, and I now believe that anyone can reasonably consider an upgrade to OS/2 knowing that they're choosing a superior product to what Windows 95 has to offer.

KEN BARD, *via PC MagNet*



Microsoft has made leaps and bounds with Windows 95, but the product is still lacking.

Why isn't Microsoft putting into Windows NT the amount of sweat that's being wasted on Windows 95? For this kind of effort, NT could be made scalable to cover multiple market niches and to deliver a better product to boot. Maybe, if we're lucky, this whole Windows 95 exercise is a facade for doing just that.

BOBBY R. TREAT, *via the Internet*

Hats off to your in-depth analysis of operating systems. I for one cannot wait for Windows 95. It promises to be the most advanced, complete operating system on the market. The only problem I anticipate is the training, or retraining, of users.

MICHAEL E. SCHLENK, *via the Internet*

With Windows 3.1 I'd be frustrated to find I had insufficient memory to spell-check a document without closing an application. My problems went away with Windows 95, and my system has never operated more smoothly.

JOHN R. FRANKS, *Cincinnati, Ohio*

Waiting and reading about Windows 95 and then having to wait some more has been terrible; one does nothing but twiddle one's thumbs and listen to idle speculation. My wife and son have moved over to the Macintosh, and to quote my son, "After using a Macintosh, why would anybody want to go back to Windows?" So why do I continue using my PC? Because I have it all to myself: The rest of the family is fighting over the Mac.

DANIEL GAEDDERT, *Georgetown, Kentucky*

Windows 95's beta version has been around long enough here in Australia to allow the production of more bootleg copies than we've got sheep. In the future, maybe Microsoft shouldn't force itself into a limited time frame for delivering the promised goods; instead, the name should be set far into the future. Windows 2001 is a snappy name, and it even has a nice change-of-millennia touch.

DAVE INGHAM, *Woolwich, Australia*

Who decreed one operating system per person? To run the applications and hardware we have now, and those we'll have in the future, we'll need to have multiple operating systems.

BETTIE KREPLICK, *Dunedin, Florida*

Previous letters published in *PC Magazine*, both mine and others, have criticized your operating-system coverage as being too one-sided. The comparative style used in your issue focusing on operating-system topics is a much more useful approach.

BARRY A. MANN, *Philadelphia, Pennsylvania*

OPERATING-SYSTEM ATTITUDE

John C. Dvorak's attitude, as expressed in his sidebar to your Windows 95 coverage ("OS/2 Warp: Deep, Rich, and Powerful," May 16, 1995, page 117), does little to gain converts to his operating system of choice. Like most computer users, I go not where Microsoft is but where the applications are. Walk into any software store and you can see hundreds of DOS/Windows products but few native OS/2 products. OS/2 Warp is indeed deep, rich, and powerful in many ways, but it just doesn't fill the bill for what most computer users, beginning or advanced, are looking for. It's an excellent product that falls squarely between the cracks in the operating-system wars.

TIM GERCHMEZ, *via the Internet*

Dvorak's comments are extremely insulting. Warp's multitasking abilities won't matter to me if my scanner isn't compatible with the operating system. I see no reason to invest in Warp knowing full well that it will not support the new breed of 32-bit Windows applications. The Windows 95 beta has already proven more compatible with my legacy hardware and software than any version of OS/2 ever was.

ERIC BURKE, *Mt. Vernon, Illinois*

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CIRCLE 348 ON READER SERVICE CARD

Letters

The consensus in your series of articles on Windows 95 appears to be that the package represents a decent compromise between what Windows 3.1 was and what Windows 95 could have been. And yet Jim Seymour, in the sidebar "Windows 95" (page 116), considers it to be the "best bet" for the mainstream?

STEVE YATES, *via the Internet*

THANKS FOR THE MEMORIES

In his column "Breaking Up Is Hard to Do" (April 25, 1995), Michael J. Miller states that the downside of breaking up Microsoft might be that "we find ourselves yearning for the 'good old days' when one company set the standards." If indeed these are the good days, then how do you define "bad"? Users have nothing to lose and everything to gain by a breakup of the Microsoft juggernaut.

WILLIAM B. FANKBONER,
La Quinta, California

I agree with Miller's comments that there's no need for government to step in with respect to Microsoft. The very essence of this capitalistic society is to minimize government involvement and let the market fend for itself. In this game, where everyone is trying to get a piece of the pie, the strong get the pie, and the weak. ..well, they become the pie.

KEN WEBSTER, *Detroit, Michigan*

A FULLER PICTURE

The story on Plug and Play products ("Effortless Upgrades," May 16, 1995) incompletely covers Future Domain Corp.'s offerings. In addition to the Plug and Play Valuepak included in your review, Future Domain also has SCSI2GO, a $279 Plug and Play PCMCIA SCSI-2 controller, and the TMC-3260SVP, a $195 PCI/SCSI-2 controller.

DON COFFIN,
Director of Product Marketing,
Future Domain Corp., Irvine, California

DO YOU HAVE A BOTTOMLESS WALLET?

While I agree with John C. Dvorak that the newest equipment generally includes enhancements that improve productivity ("The Case for New Equipment," April 25, 1995), for every home user to replace an entire system every two years is outrageous. The average home user, and even many users in the workplace, can maintain an excellent level of productivity with any PC above a 286.

FRED J. DEAUX, JR., *via PC MagNet*

I live on the planet Earth. Dvorak's column makes me suspect he comes from the planet Krypton. From my experience in a Fortune 500 high-tech company, anyone wanting new software or hardware has to run a gauntlet of approvals. One has to show that the purchase is essential, which is not necessarily defined as saving time.

MATTHEW W. SLATE,
Sudbury, Massachusetts

I certainly agree with Dvorak about the treadmill concept. I have been on one for years and do not regret it for a single minute. I must say that all four of my computers, from the Texas 99/A to the Pentium/90 have been well worth their respective investments.

ALVIN G. EBERT,
Waterford, Connecticut

HOW TO CONTACT US

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CORRECTIONS AND AMPLIFICATIONS

In our review of Matrox Graphics' MGA Millennium ("Ultrafast Graphics: The Professional's Choice," June 27, 1995), our characterization of its performance was, in certain respects, incomplete and inaccurate. We incorrectly represented its performance in high-end graphics applications by publishing the results for only one test in that area (the Raster Rotate test). In fact, on a wide range of unpublished tests that PC Magazine Labs performed with Adobe Photoshop and QuarkXPress, including file-load, zoom, scroll, and rotate tests, the Millennium and the #9 Imagine 128 Pro 8MB delivered comparable performance. The article was, however, accurate in stating that the Millennium was the fastest product reviewed for mainstream graphics.

The article also contained several technical errors. Specifically, our discussion of alpha-channel and packed-pixel technologies was incorrect. We should also clarify our comment concerning DCI in the MGA Impression Plus review, which should have indicated that DCI support is most useful for WinG games and DCI video playback under Windows 3.1. Our statement that the Millennium's 3-D acceleration is limited to 1,024-by-768 resolution is also inaccurate. Without double buffering, the card supports up to 1,600-by-1,200 resolution.

Several items were incomplete or unclear. We should have mentioned that the Millennium is also available in configurations of 2MB (street price, $339) and 2MB with a 2MB upgrade module (street price, $529), and each is upgradable to an 8MB configuration (street price, $848). In addition, the review inappropriately omitted mention of color calibration, hardware zoom, virtual desktop, accelerated video-playback support, and energy-saving features.

Furthermore, we were unclear in our reference to the price/performance ratio within the Millennium review. Our price/performance evaluation encompassed all the products in the roundup; in fact, the Millennium clearly had a better price/performance ratio than the other 8MB product reviewed. Overall, we felt the Millennium was a good product with many excellent features. It offers performance in high-end graphics applications comparable with that of our Editors' Choice winner. But its extreme newness at the time of the review, as evidenced by a few glitches and rough edges we encountered, precluded it from receiving Editors' Choice consideration.

Our review of Hercules Computer Technology's Graphite Terminator Professional in the same story incorrectly stated that this board was a poor performer on our Vector File Open test. As the published benchmark test scores correctly show, it was one of the top performers on this test.

Several reviews in the same story used the term DLD (Display List Driver), which is a registered trademark of Panacea Inc.

The price of the Dell Latitude 475C, which earned an honorable mention in our roundup of color notebooks ("Your Portable Persona," August 1995), was misstated in the Editors' Choice sidebar. The correct price, as quoted in the review and the Summary of Features table, is $2,298.

In the review of IBM Visualizer for OS/2 1.11 ("SQL Query and Feporting: Straight Answers, Limited Risks," June 13, 1995), the correct toll-free number is 800-426-2255.

In the First Looks review "Tek Illustrator Draws a Rough Sketch" (June 13, 1995), we stated that the program could not suppress its toolbar and did not support drag-and-drop operations. Actually, the toolbar can be suppressed, and drag-and-drop functionality is available, activated via a selection on the main menu.

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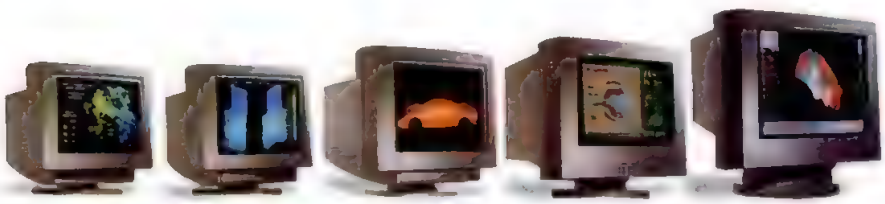

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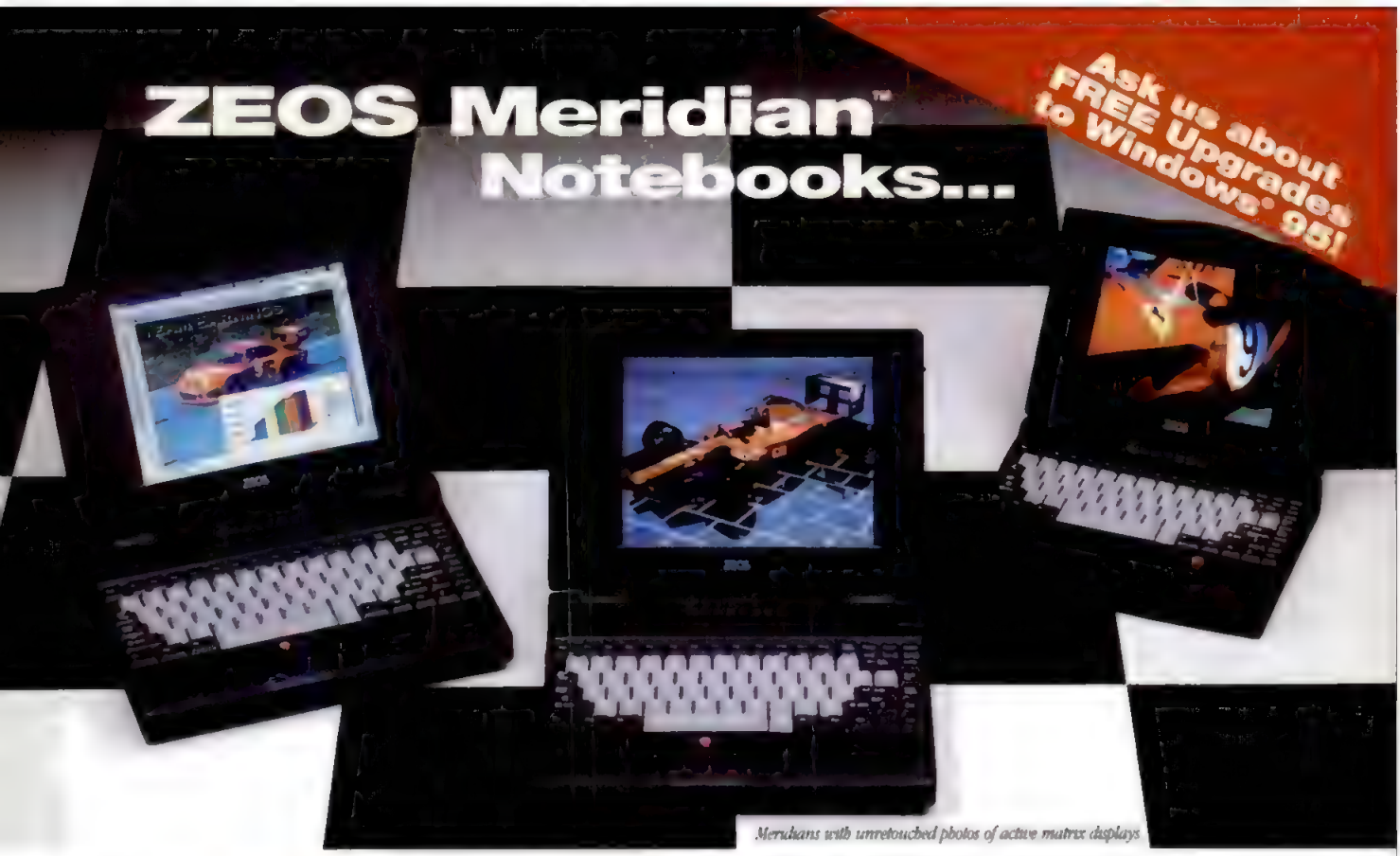

Meridians with unretouched photos of active matrix displays

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Meridian 400 Subnotebook

WINDOWS 1995 WIN 100 May 1995

"ZEOS is out to prove that good things do come in small packages with its Meridian 400C subnotebook," reported *Windows Magazine*.

At 3.9 pounds, the Meridian 400 is molded with a special carbon-fiber material that cuts weight and improves durability. And with a DX4-100 MHz processor *standard*, hard drives to 350MB, and RAM that's user upgradable to 20MB, this notebook is "faster than a speeding desktop," as *Computer Shopper* said.

The 400 features active and dual-scan color screen options. You also get two Type II PCMCIA slots and an external ultra-light 3.5" 1.44MB floppy drive (included in Packages 2 and 3).

Meridian 800 Notebook

WINDOWS 1995 WIN 100 May 1995

"The 800C notebook offers sleek styling, solid construction and hot performance....one of the fastest notebooks we've ever tested," said *Windows Magazine*.

At 6.3 pounds, the Meridian 800 full-size notebook is light enough to travel anywhere yet it's large enough to use for presentations and everyday computing. With its standard DX4-100 MHz processor, removable hard drives to 528MB, and RAM that's user upgradable to 20MB, this notebook is the raciest thing around.

For your viewing pleasure, the 800 is available with your choice of color displays—a whopping 10.3" dual scan or 9.5" active. You also get two Type II or one Type III PCMCIA slots, and an internal 3.5" 1.44MB floppy drive.

Meridian 850 Notebook: Pentium™ Processor Power

Ultimate horsepower that takes the checkered flag! The Meridian 850 gives you supreme Pentium processor performance in a bundle weighing

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only 6.8 pounds. It's light enough to race around the world with you yet it's powerful and fast enough for the most demanding computing.

For turbo power, the Meridian 850 comes with your choice of 75 MHz or 90 MHz Pentium processor; user upgradable RAM to 32MB, 256K synchronous SRAM cache, and a removable hard drive to 1.3GB.

For the best viewing, the 850 is available with your choice of color displays—a mammoth 10.3" *SVGA* (800 x 600) dual scan or 9.5" VGA active matrix. You also get 16-bit stereo sound through audio jacks (Sound Blaster Pro compatible) for the best in portable multimedia, two Type II or one Type III PCMCIA slots, and an internal 3.5" 1.44MB floppy.

Buy With Confidence

No matter which ZEOS notebook you purchase, you'll be getting the best service and support in the business! ZEOS has won seven *PC Magazine* Readers' Choice for Service & Reliability awards. And, ZEOS was the first to provide 24-hour toll-free technical support.

The ZEOS Meridian will support you as you face the daily rat race. It'll organize each event, tally the results, and even report back to the office—lap by lap. What a way to work—whether you're in the office or speeding around. For a swift notebook that's raring to go 24-hours-a-day, call your ZEOS Systems Consultant today at 800-554-7172.

Package 1			Package 2			Package 3		
	400C	800C		400C	800C		400C	800C
DX4-100	$2195	$2495	DX4-100	$2495	$2695	DX4-100	CN! $2795	CN! $2995
➤ 4MB RAM ➤ 260MB IDE hard drive ➤ 800: Internal 3.5" 1.44MB floppy drive ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Works**			➤ 8MB RAM ➤ 350MB IDE hard drive ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ Custom nylon carrying case ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Works**			➤ 8MB RAM ➤ IDE hard drive. 400: 350MB, 800: 528MB ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ **14.4 PCMCIA fax/modem** ➤ Custom carrying case. 400: Leather, 800: Nylon ➤ Extra battery ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Works**		
Pentium™ Processor		850C	Pentium™ Processor		850C	Pentium™ Processor		850C
75 MHz		$3295	75 MHz		CN! $3795	75 MHz		CN! $4195
90 MHz		$3495	90 MHz		$3995	90 MHz		$4395
➤ 8MB RAM, 256K synchronous SRAM cache ➤ 528M IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Office Pro**			➤ 16MB RAM, 256K synchronous SRAM cache ➤ **810MB** IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ Custom nylon carrying case ➤ Extra battery ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Office Pro**			➤ 16MB RAM, 256K synchronous SRAM cache ➤ **1.3GB** IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ Integrated 16-bit stereo sound ➤ External amplified speakers ➤ **14.4 PCMCIA fax/modem** ➤ Custom nylon carrying case ➤ Extra battery ➤ MS-DOS 6.2, Windows for Workgroups 3.11 ➤ **MS Office Pro**		

Prices shown include dual scan color display.

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- ➤ 400 & 800: Intel® DX4-100 processor. 850: Intel® Pentium processor, 75 MHz or 90 MHz.
- ➤ 400 & 800: RAM expandable to 20MB. 850: RAM expandable to 32MB.
- ➤ IDE upgradable HDD. 400: to 350MB, 800: to 528MB, 850: to 1.3GB.
- ➤ PCMCIA slots. 400: 2 Type II, 800 & 850: 2 Type II or 1 Type III.
- ➤ Local bus video with 1MB video RAM.
- ➤ Display: Color VGA backlit LCD, up to 256 colors. 400: 640 x 480 7.9" DSTN or active matrix. 800: 640 x 480 10.3" DSTN or 9.5" active matrix. 850: **800 x 600** 10.3" DSTN SVGA or 9.5" 640 x 480 active matrix.
- ➤ Supports an external SVGA color monitor at resolutions up to 1024 x 768.
- ➤ 84-key keyboard with embedded numeric keypad, 12 dedicated function keys and inverted "T" arrow keys. Integrated TruePoint pointing device.
- ➤ Ports: Serial, parallel (850: enhanced EPP & ECP), external VGA video, external keyboard or PS/2 mouse(800 & 850 both). 400 also with external floppy drive. 850 also with mic-in and stereo speaker-out.
- ➤ Replaceable, rechargeable NiMH battery.
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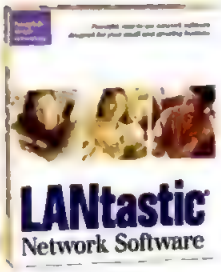

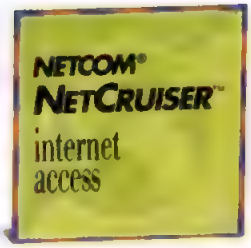

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Turbo-charge your PC with quad-speed power and performance. Blaster CD™ 4x offers fast 600 KB/second data transfer, 250ms access, an IDE interface card, plus the newest edition of Grolier Multimedia Encyclopedia.

2. The affordable way.

Sound Blaster Value CD™ 4x turns your PC into a multimedia adventure by combining best-selling hardware and action-packed software in a very affordable kit. Includes a 16-bit stereo Sound Blaster®, quad-speed CD-ROM, stereo speakers, plus ultra-popular titles like Grolier Multimedia Encyclopedia, Ultima VII, Shadowcaster and more.

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Sound Blaster Digital Schoolhouse™ 4x turns an ordinary PC into an awesome educational tool. See how cool learning can be with a 16-bit Sound Blaster, speakers, quad-speed CD-ROM, plus sought-after education titles like Allie's Playhouse, Kid Works 2, Scooter's Magic Castle and much more.

Six High-Speed Ways to Blast into Multimedia

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All Eyes on Optical Storage

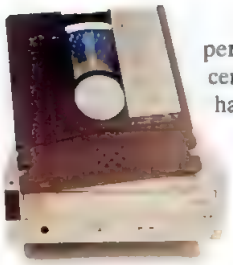
The biggest challenge to hard disks yet?

Reports of the imminent demise of the magnetic hard disk may be greatly exaggerated, but the relatively small optical disk market is poised as a serious contender for mass storage on the desktop. As the 40-year-old magnetic hard disk technology approaches its limits, optical storage ventures beyond the backup market and a step closer to mainstream desktops. Researchers have cleared technical hurdles; the need for massive storage on the desktop is real; and manufacturers have cut prices.

There's a big incentive for PC makers to make the switch: reducing the number of returns due to hard disk failures. That's one reason why the NeXT machine had an optical disk instead of a magnetic hard disk. PC manufacturers now think it's a good idea. Early next year, two major PC makers plan to equip servers with 4GB removable magneto-optical (MO) drive instead of hard disks.

The key selling point of optical disks is removability. If the drive crashes, you can remove the disk and recover your data on another drive. Optical media is also more stable than magnetic media because there's no direct contact between the head and the disk. Still, hard disks have overwhelming advantages. "The removability of magneto-optical storage is very compelling for graphics design, desktop publishing, CAD/CAM, and imaging, but MO has no way to compete against hard disks in capacity, cost per megabyte, and performance," says Patty Chang, director and principal analyst at the market research firm Dataquest.

Riding the crest of the optical market, Pinnacle Micro has made a significant investment in research and development. And it's paying off. A group of 25 engineers at its R & D facility in Colorado Springs has developed the Apex, a rewritable MO drive that stores 4.6GB of data by using *light intensity modulation* to change the state of the disk by turning a magnetic layer on and off. The next version will store twice as much data by using more of the disk's surface, recording in the disk's grooves as well as the lands. According to Pinnacle Micro, the drive will cost 37 cents per megabyte, compared with 58 cents for equivalent storage on a hard disk.



Panasonic's 650MB PD drive

Meanwhile, Panasonic, whose parent company is Japanese electronics giant Matsushita, is putting its weight behind the competing optical technology known as phase change. It's position- PowerDrive (l phase-change di Ms as well as M D-ROM dri- ve onic will also us ng technique to ks. Both the A a technique cal ng data. neto-optical pr ble optical dis sus Dis Multimedia CD-ROM are locked in a struggle for the high-density CD-ROM standard. The write-once format is targeted to replace the current CD-ROM format as a new distribution medium.

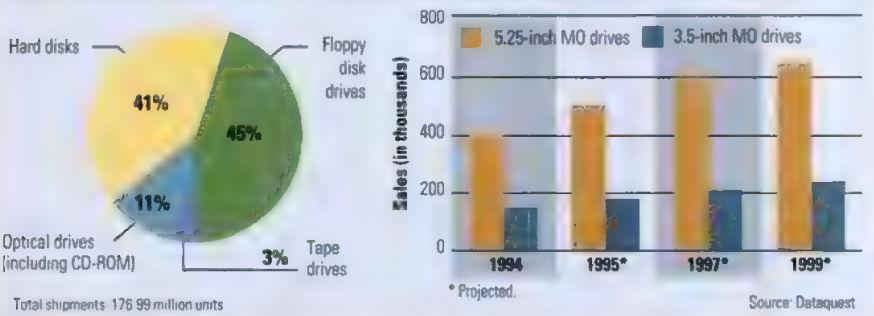
Pinnacle's MO drive stores 2.3GB per side.

All these storage choices are bound to lead to buyer shock and confusion. Buy a PD drive or an Apex drive today, and you'll still need to buy a new high-density CD-ROM drive once the industry moves to a new CD-ROM standard next year. Panasonic's Rich Harada says that PD2, expected to ship in early 1998, will read both high-density CD-ROM formats. Manufacturers still see a ripe market in optical drives today. By the end of the year, Fujitsu plans to introduce a 230MB removable, rewritable MO drive that fits into a notebook's floppy drive bay.

Today's advances in optical storage are only baby steps compared with its potential once shorter-wavelength lasers are ready for the production of 50GB disks. In the long run, the gating factor may turn out to be the PC bus's inability to keep pace with the drive's increases in throughput.—*Carol Levin*

A Small but Feisty Market

Optical drives account for a slim slice of the storage market, but sales of magneto-optical drives are expected to climb.



Photography by Thom O'Connor

Pipeline *By Robin Raskin*

The Revenge of the Nerds

This is my last column for *PC Magazine,* so the pressure is on for me to squeeze some big ideas into a small space. I'm reminded of an industry panel that Bill Machrone and I participated in at the International Center for Communications here in New York about a year ago. It was titled *The Revenge of the Nerds.* Bill and I found ourselves confronting a rather artsy crowd of filmmakers, writers, and other media types. They grilled us on everything from gender differences, censorship, pornography, privacy, and digital cash to the future of the arts. Of course, there was an electronic tie-in, but not much of one. I remember remarking to Bill that I couldn't believe a couple of nerds like us were now considered spokespeople on issues that far transcended processor speeds or GDI calls.

With each passing day at *PC Magazine,* I've found that my responsibilities—not as an editor of a magazine, but as a spokesperson for putting technology into the proper perspective—have grown. At *PC Magazine* we're all too aware that we now have influence over everything from antitrust legislation to the interpretation of the First Amendment.

We watch as a new generation of computer users who think of the computer as a social tool emerges. With hindsight, it becomes almost laughable to think how many hours I fretted that the computer would raise a generation of antisocial nerds whose entire lives were private, spent talking in code to their machines.

Always the worrier, I now have a new and possibly more real concern on my mind. The danger we face now lies in our ability to construct separate electronic realities that may cause us to lose touch with one another. In an article that portrayed the Oklahoma bombing as a natural extension of "the medium is the message," *Harper*'s editor Lewis Lapham wrote, "The marvel of postmodern communications—500 television channels, CD-ROM, the Internet—invites each of us to construct a preferred reality. We need never see or talk to anybody with whom we don't agree."

When I look back on the past two years of Pipeline columns, I realize that over and over, I've been asking you, as readers, to step outside of the world of *PC Magazine* benchmark tests and argue important issues among yourselves. Some of these issues are large and some are small, but all rely on a core of technical knowledge that you are uniquely positioned to understand. As computer nerds we have become tremendously powerful, and the responsibility of that power should not be taken lightly.

I'm not arguing for you to take one position or another; I'm simply asking you to keep arguing. Get on-line with those you disagree with. Stay abreast of government legislation that may affect your computing life. Get involved with your schools and your communities and share your knowledge so that others can better understand the issues. Your informed opinions are the best defense we have to insure that the uniqueness of this computer experience of ours is not taken away—and that it doesn't ruin us.

And speaking of arguments, thanks for all the great ones you've given me over the years. A columnist couldn't ask for a sharper constituency.

Robin Raskin is now the editor-in-chief of FamilyPC.

Microsoft Fast-Forwards Video Strategy

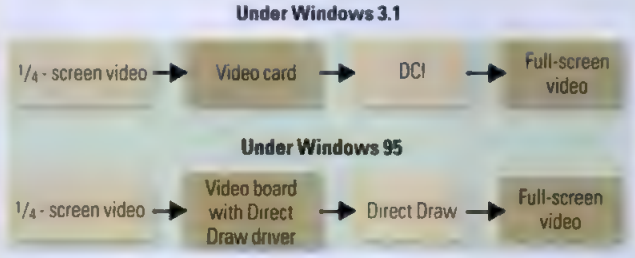
IF YOU RECENTLY BOUGHT A graphics card and frequently play video files, you could be in for a surprise after you install Windows 95: Video playback performance may drop. That's because Microsoft changed Windows 95's video playback architecture in midstream, abandoning the Display Control Interface (DCI) in favor of a more robust specification called Direct Draw. To take advantage of Direct Draw, though, you'll need an updated driver from your video card manufacturer.

Formulated in 1993 by Intel and Microsoft, DCI efficiently sends video through the Windows Graphics Display Interface (GDI) and lets video cards share video decompression tasks with the CPU. DCI increases display performance by 30 percent and enables features such as scaling video to full screen. Most graphics cards shipped today support DCI, which until recently was a cornerstone of Microsoft's multimedia strategy.

Then, in April, Microsoft announced Direct Draw, which replaces DCI and offers additional functions such as texture mapping, overlaying, rotating, and mirroring. "Listening to games developers, we realized that DCI was ill-suited for their needs," explains Steve Banfield, Microsoft's multimedia group program manager. "By providing access to a broader range of graphics functions, Direct Draw achieves better-than-DOS performance under Windows and provides a stable environment for games developers."

Stretching the Video Window

For functions such as scaling and color-space conversion, which are supported under DCI but not Direct Draw, you'll need a Direct Draw driver.



The good news: Direct Draw will boost video performance once you install a Direct Draw driver from your video card manufacturer. The hitch: Direct Draw is not fully backward-compatible with DCI. "We made the tough decision to forgo complete backward-compatibility to enable the next generation of entertainment applications," explains Banfield.

Graphics card and chip vendors are now busily writing Direct Draw drivers. "We're working with video card developers to make the changeover as painless as possible," says Banfield.—*Jan Ozer*

It May Plug, but Will It Play?

MICROSOFT FACES MANY CHALlenges as it rolls out Win 95—from winning users over to a new interface to facilitating a level of compatibility previously unseen on the PC platform. At least in the short run, Plug and Play hardware compatibility could be the biggest challenge. Even other operating systems lauded for hardware compatibility, such as the Macintosh OS, haven't attempted compatibility with the number of devices the new Windows is expected to work with.

Microsoft's Carl Stork, director of Windows hardware programs, put some numbers on the problem. He said over 400 hardware devices work automatically with Plug and Play and won't require any user intervention. He also said that Win 95 includes a database of over 1,600 information files for existing hardware. Many devices will require your intervention at various levels, though.

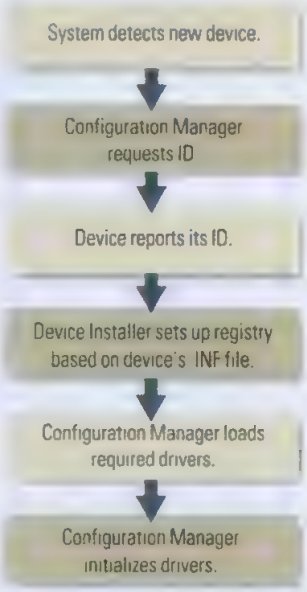
Stork is armed with clues as to what kinds of devices are not likely to install automatically. Legacy hardware—legacy graphics cards in particular—are high on the list of potential problems. Legacy PCI cards of all kinds could create problems, according to Stork. Before PCI 2.0, chip-specific—not board- or subsystem-specific—IDs were the norm. PCI 2.1 adds Subsystem IDs and Subsystem Vendor IDs, which Win 95 supports.

Win 95's Configuration Manager and Detection Manager depend on vendor-supplied information files, aliases, and other IDs to facilitate automatic installation (see diagram). Many of the anticipated hardware problems will be a result of common aliases. As an example, Stork cites an IBM Token-Ring card that uses the same alias as a Sound Blaster card. According to Stork, "Many clone cards—and not just graphics cards—have multiple upgrade variants that Win 95 won't detect." Stork also says that clone cards with superset drivers and other resource conflicts mean potential Plug and Play trip-ups.

In many cases, running Win 95's Add New Hardware Wizard will coax the right settings. If not, pick up the phone and ponder that time-honored computing paradox: Is it a hardware problem or a software problem?—*Sebastian Rupley*

Plug and Play: How It Works

Windows 95 matches new hardware devices to a database of over 2,000 Information Files and IDs



Source: Microsoft

"Hello?. . .Windows 95 Support Line?"

HOW DO YOU GEAR UP FOR WHAT is almost certain to be the most massive software upgrade in history? Two years ago, Microsoft began laying the groundwork for a giant technical support infrastructure to accompany the launch of Windows 95. While it has reassured customers that upgrading will be a cinch, it seems to be preparing for the worst.

Microsoft anticipates that 40 percent of all the support calls it will get will come in the first three weeks after Windows 95 hits the market. "It's like when there's an announcement that the Rolling Stones are coming to town and everyone rushes to get tickets," says Linda Glenicki, general manager of end user support at Microsoft.

In the past year, Microsoft has recruited a tech support staff that's 1,650-strong (in comparison, Windows 3.1 had one-fifth as many support techs); formed the Windows 95 Launch Support Team by partnering with five third-party support companies throughout the U.S.; and established a compatibility hotline with recorded information on compatibility issues and workarounds.

Microsoft is also offering a variety of ways for customers to get tech support

beyond phone and fax, including forums on America Online, CompuServe, the Microsoft Network, and the World-Wide Web. A series of eight training videotapes are available. And if you've got a satellite downlink, you can call in and Microsoft support engineers will answer your questions live. (For details on obtaining support, see "Windows 95 Support: Whatever Suits You Best" in this issue's feature story, "The Windows 95 Upgrade Clinic".)

During the Windows 95 Preview Program, in which 350,000 people paid $32 for the honor of participating, Microsoft gathered valuable information about customers' tech support needs. "We had a fair number of questions about compatibility," says Glenicki. Compatibility, especially with legacy hardware, could be the biggest support issue of all (see "It May Plug, But Will It Play?").

Microsoft is now charging for all networking-related questions. While the first 90 days of support are free for all non-networking questions, you'll pay $35 per incident or $1.95 per minute for all networking questions. All support is fee-based after the first 90 days and will be available from Microsoft, as well as from the third-party support companies, including Digital Equipment Corp., Softmart, Keane, Stream International, Technology Service Solutions, and Unisys.

Even with these resources in place, however, Microsoft admits that with 85 million copies of Windows on desktops today, it won't be able to answer every call during the first three weeks.—*Carol Levin*

Illustration by Keith Bendis

Pumping Up the Volume in Cyberspace

FROM INDUSTRY POWERHOUSES Oracle, Intel, and Microsoft to alternative Seattle rock bands Swamp Shack and Barking Spiders, the race is on to overhaul on-line's sound and video content.

Intel CEO Andy Grove and Oracle CEO Lawrence Ellison have announced a long-term agreement to collaborate on technology that marries on-line content with multimedia. They envision applications for ordering video-on-demand, exchanging video mail, and sampling music before making an on-line purchase. Ellison says he's striking deals with entertainment companies to launch an on-line service based on Oracle's Media Server software.

The Internet won't be left behind as on-line content gets glitzier. Leading the sound charge is Seattle's Progressive Networks, maker of RealAudio software. From the RealAudio Web site at *http://www.realaudio.com* you can download the client software and listen to real-time news and music.

Norman Hajjar, president of Seattle's Hajjar/Kaufman advertising agency, has used the technology to launch one of the first Internet-only radio stations (*http://www.hkweb.com/radio*). Tune into Radio HK for broadcasts of alternative Seattle bands and offbeat audio commentary from Timothy Leary and Radio HK listeners. "Before RealAudio software, audio on the Internet meant sitting and waiting during long downloads," he says.

Hajjar and Progressive Networks' president Rob Glaser also point to new business models arising out of multimedia-based on-line content. An NFL team owner has contacted them about "broadcasting" games on-line, accompanied by potentially lucrative on-line advertisements.

Microsoft isn't ignoring the convergence of multimedia with on-line content. Progressive Networks has penned an agreement with Microsoft and Netscape to include RealAudio client software in the Microsoft Network and the Web browser in Win 95. Win 95 will facilitate video (via software-based MPEG decoding), animated graphics (via Rendermorphics RealityLab 3-D), and real-time sound (via RealAudio).

Meanwhile, bigger and bigger pipes will be needed to carry multimedia. While RealAudio doesn't require an ISDN line, it definitely helps. T1 lines can support about 1,000 Radio HK listeners, while T3 lines can bump the maximum concurrent accesses up to 4,000 listeners. —*Sebastian Rupley*

Top Retail Software

Current ranking	Last issue	Product company
1	—	**Remove-IT 2.0** *Vertisoft Systems Inc.*
2	6	**Procomm Plus for Windows 2.11** *Datastorm Technologies Inc.*
3	1	**UnInstaller 3** *MicroHelp Inc.*
4	5	**Internet-in-a-Box 2.0** *Spry Inc.*
5	—	**pcAnywhere 2.0** *Symantec Corp.*
6	—	**HomeSafe** *MicroForum*
7	9	**MS-DOS 6.22 Upgrade** *Microsoft Corp.*
8	7	**WordPerfect 6.1 for Windows Upgrade** *Novell Inc.*
9	—	**ViruScan 2.2** *McAfee Associates*
10	—	**Netscape Navigator Personal Edition** *Netscape Communications Corp.*

This list ranks PC business programs according to the total number of copies they shipped to over 12,000 stores and resellers in the week ending July 1, 1995. The list cannot be interpreted as a picture of the entire software market. Adapted from a compilation by Ingram Micro.

Making Movies

EVERYONE SEEMS TO HAVE A great idea for a CD-ROM title. All too often, though, splashy new titles fall far short of expectations. Now that Apple and Microsoft have introduced tools for making navigable digital movies, an improvement in production values can't be far behind.

Apple's QuickTime VR and Microsoft's Surround Video turn photos into navigable movies, letting you create and explore a virtual space without virtual reality peripherals such as datagloves and helmets. Simon & Schuster Interactive's "Star Trek: The Next Generation Interactive Technical Manual" uses an early version of QuickTime VR. Future applications include walkthroughs of architects' floorplans, educational programs for exploration of distant locales, and interactive museum displays.

While photographers are no strangers to the panoramic photo collage—a series of overlapped photos that creates an illusion of space on a two-dimensional surface—attempts at recreating that effect in a video file played on the PC have been feeble.

QuickTime VR uses scanned 35-mm photos and rendered images from 3-D applications. The Stitcher, an application that's part of the QuickTime VR Authoring Tools Suite, combines the images into one 360-degree view. Microsoft Surround Video files are created with scanned photographs taken with a panoramic camera or with computer-rendered images. As you navigate a Surround Video file, you feel as if you're turning your head from left to right. Unlike linear QuickTime or Video for Windows files, QuickTime VR and Surround Video add interactivity by giving you control over the movie file's playback. As you move the mouse to the left, the scene before you scrolls by to the right.

Apple's QuickTime VR stitches photos together to create a navigable video and the illusion of space.

For more information on Microsoft Surround Video, send e-mail to *surround@microsoft.com*. For more information on QuickTime VR, check out *http://quicktime.apple.com/qtvr.html*.—*Brendon Macaraeg*

Art courtesy of Apple Computer

FOR THE LAST TWO YEARS
WE'VE WORKED WITH MICROSOFT
TO MAKE SURE WINDOWS 95 USERS
GET WHAT THEY NEED.

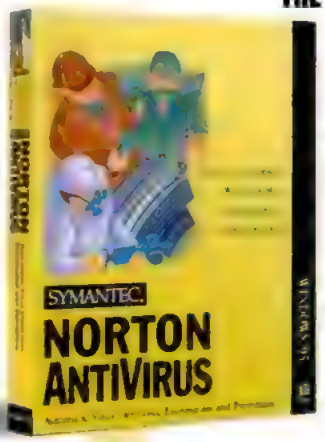
SYMANTEC.

CIRCLE 186 ON READER SERVICE CARD

You've waited. And waited. And now it's here. The most powerful PC operating system known to man and mouse.

But before you settle down to work in the 32-bit world of Windows 95, there are a few things you should know.

INFECTION PREVENTION IN THE NEW WORLD.



First, Windows 95 doesn't have any virus prevention or protection built in.

And on the networked, file-sharing superhighway of life, the chances that your PC will be exposed to a virus are far greater than you might think.

And guess what? Your old anti-virus software won't work in the brave new world of Windows 95. But thousands of old viruses will.

Which is why you should install Norton AntiVirus® for Windows 95 from day one.

Norton AntiVirus is verified to protect you from 100% of all viruses known to be in circulation.*

Norton AntiVirus for Windows 95 protects you from virus attacks.

But you need more than just protection from a long list of known viruses. Which is all that ordinary anti-virus packages can offer.

Norton AntiVirus also offers you the most complete protection from unknown viruses. Thanks to our unique virus detection technology, Norton AntiVirus spots virus activity in your system and eradicates it before it can do any serious damage.

So even if you encounter a virus that was just created yesterday by some hacker with a bad frozen pizza habit, Norton AntiVirus will find it and stop it.

And when could you possibly need protection from unknown viruses more than in a brand-new operating system?

A 32-BIT OPERATING SYSTEM DEMANDS 32-BIT PROTECTION.

Another thing you may not know is that your old 16-bit utilities won't work in Windows 95.

Work faster and more productively with Norton Navigator for Windows 95.

PREVENTION, PROTECTION WINDOWS 95

And the utilities included in Windows 95 itself won't give you much protection in a 32-bit world.

Only native 32-bit utilities can give you adequate system protection in a 32-bit environment.

Which is why you need to upgrade your utilities to Norton Utilities® for Windows 95.

The first thing Norton Utilities will do for you is optimize your system for Windows 95 with a Pre-installation Tune-up.

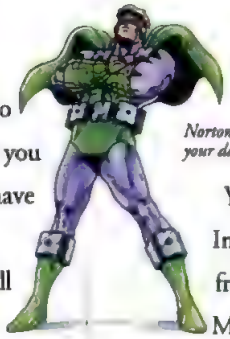
Then Norton Utilities runs continuously in the background, monitoring your system and automatically launching the right tools to maintain system performance and prevent system crashes.

**Verified in independent tests conducted by NCSA and [illegible] Norton AntiVirus and Norton [illegible] are registered trademarks [illegible] In Australia, call 2-879-6577. In Europe, call 31-71-353111.*

*1995. **Trade-up editions will run only when specified Symantec, Central Point, McAfee and Norton Navigator is a trademark of Symantec Corporation. All other brand names or trademarks*

And if something does go wrong, Norton Utilities gives you the data recovery tools users have relied on from day one.

So from the day you install Windows 95, your system is stable and your files are protected.



Norton Utilities keeps your data safe from harm.

THE MORE WORK YOU DO, THE MORE WORK NORTON NAVIGATOR WILL DO FOR YOU.

Windows 95 has lots of terrific features to make life easier. Like Plug 'N Play. And long file names.

AND PRODUCTIVITY FOR FROM DAY ONE.

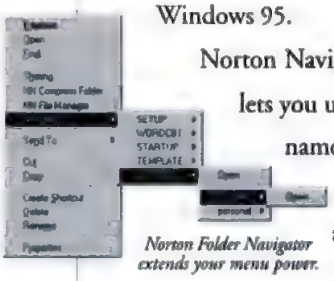
But what about getting even more out of Windows 95? Like getting more done in less time.

With Norton Navigator, you can navigate through your desktop five times faster than in Windows 95. Be more productive with multiple project-oriented desktops. Open the files you need most in a single click.

And that's just the first minute.

You can plug into your Internet connection right from the Norton File Manager. Search for text strings within files at least ten times faster. (In fact, the more files you have and the bigger they are, the more time you'll save.)

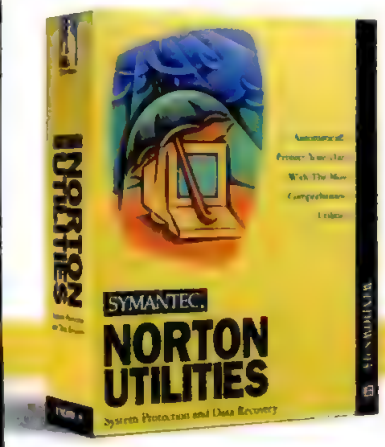
And copy a file anywhere on your hard drive or on the network with just one click. Instead of click click click click click click click click click click. Which is generally how long it takes to copy a file in Windows 95.



Norton Folder Navigator extends your menu power.

Norton Navigator also lets you use long file names for most 16-bit applications. And gives you loads of other time-saving tools like built-in PK-Zip compatible file compression and the ability to delete, move, zip or encrypt from any Open or Save dialog box.

So why waste time wading up and down menus, clicking your life away? Every minute counts.



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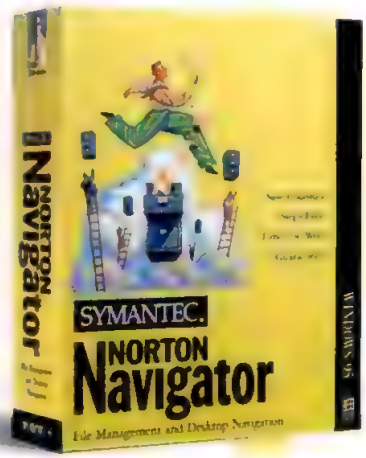
So on the day you load Windows 95, make sure you're ready. With the new Norton AntiVirus, Norton Utilities and Norton Navigator from Symantec.



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Norton AntiVirus for Windows, PC Tools, Norton Desktop for Windows, Central Point Anti-Virus, McAfee VirusScan and Dr. Solomon's Anti-Virus owners trade up to Norton AntiVirus for Windows 95 for ***$29.95.****

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Norton Desktop, PC Tools, XTree and Norton Commander owners trade up to Norton Navigator for Windows 95 for ***$39.95.****

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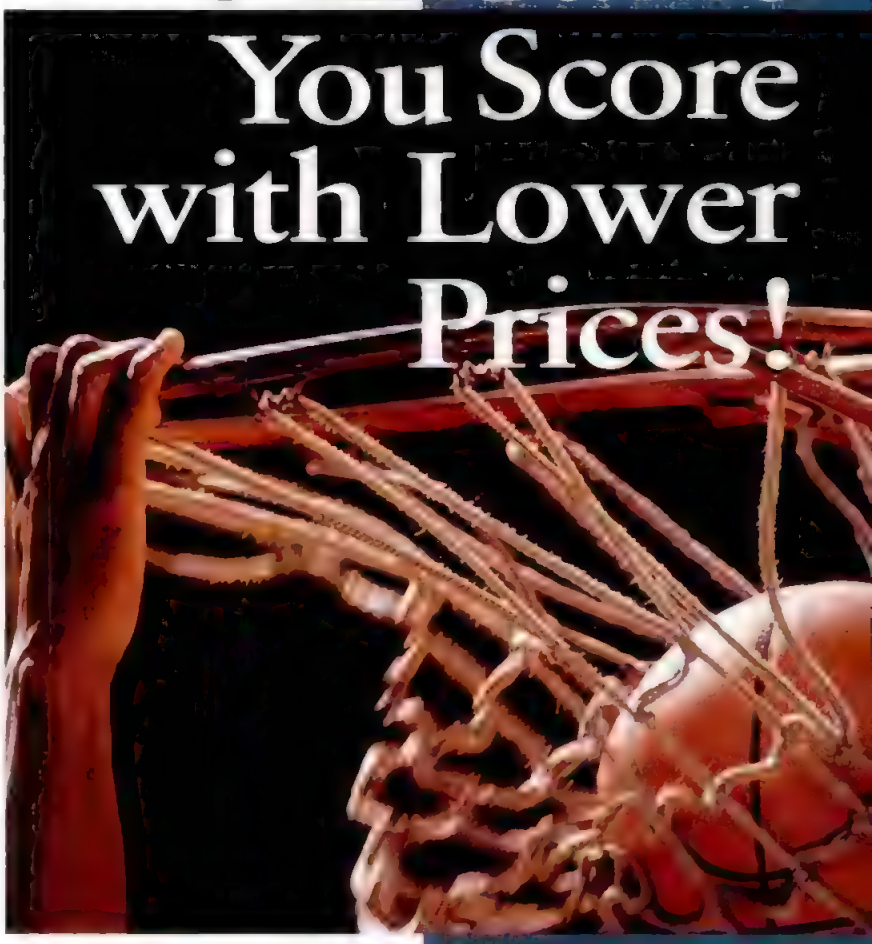
Take a look at just a few of the over 70 prestigious industry awards ATI has won in the last three years. Recently ATI's GRAPHICS XPRESSION was the only graphics accelerator in 54 tested to win PC Magazines Editors' Choice...winning out over more expensive offerings from Diamond and Matrox.

At the Height of Our Game



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CIRCLE 127 ON READER SERVICE CARD

First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

POWERPC SYSTEMS

PowerPC Systems from IBM and Motorola Lack a Strong Personality

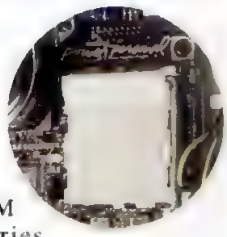
By Brian Nadel

As Apple takes the wraps off of its second-generation Power Macintosh systems (review on page 40), IBM and Motorola—the other two members of the PowerPC troika—are introducing their first mainstream PowerPC desktop systems. Aimed at power users such as financial traders, graphics professionals, and programmers, the $7,017 IBM Personal Computer Power Series 850 and the $4,850 Motorola PowerStack RISC PC MT 604-100 are prepared to stake a claim in a new era of desktop computing.

The first thing we noticed about these systems is the similarity between them. Both use the PowerPC 604 processor, run the Microsoft Windows NT 3.51 operating system (with its familiar Windows 3.1–like interface), and include built-in SCSI and networking capabilities. Primarily because the IBM has a 133-MHz processor, compared with the Motorola's 100-MHz CPU, there is a performance gulf between the two units.

The Achilles heel for Windows NT systems remains the dearth of mainstream software. With the advent of PowerPC versions of Microsoft's Word for Windows NT and Excel for Windows NT, the situation is improving, but the majority of NT applications are highly specialized. Until more mainstream applications are written for the PowerPC/Windows NT platform, you'll be better off with a Pentium-based system.

The IBM PowerSeries 850 is a marriage between the company's Pentium-based line of PCs and its Unix workstation offerings. The Power Series 850 uses the same desktop case as IBM's 350 and 750 lines and is based on the motherboard found in the company's RS/6000 line. In fact, the Power Series 850 will run a variety of operating systems—including AIX, Windows NT, and OS/2—when it is introduced later this year.



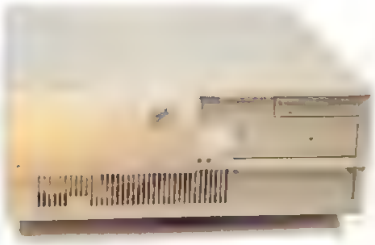


IMAGE PC: *With a PowerPC processor and 512K of external cache, IBM's Power Series 850 is a graphics workhorse. Its motherboard (inset) has a ZIF socket for future CPUs.*

The system has three free drive bays, and a riser card that contains two PCI slots, three ISA slots, and one shared expansion slot. Its 133-MHz PPC 604 processor is backed up by 512K of exter-

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DATABASES

Visual FoxPro 3.0 Moves to an Object-Oriented Future

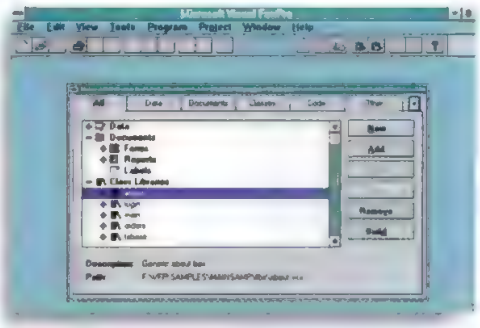
By Sal Ricciardi

Microsoft's $199 Visual FoxPro 3.0 for Windows (Professional Edition, $499) is easily the most welcome overhaul in FoxPro's product history. The enhancements—which include a move from a character-oriented database to objects, full support for the Windows-event model, and a data dictionary—will profoundly effect the way FoxPro applications are developed.

FoxPro 3.0's client/server features include upsizing tools and support for remote views and connections, making it easier to prototype business applications that scale to client/server systems. The result is that FoxPro is competitive with dedicated client/server tools like Powersoft's PowerBuilder and Borland's Delphi.

OOPS! HERE IT IS

FoxPro developers wanting to move to an object-oriented system (OOPS) will appreciate Visual FoxPro. You can create objects based on FoxPro's built-in class hierarchy or on custom classes that you create yourself. There is support for inheritance, polymorphism, and encapsulation. Classes have associated methods, events, and properties accessed through the Visual Basic–type object-dot-property syntax. FoxPro provides support protection, which means you can designate an object attribute as protected so that only methods of the same class can access it.



KEEPING THINGS TOGETHER: *The Project Manager organizes all the pieces of your application by grouping components in a collapsible outline.*

A new Visual Class Designer lets you design a class interactively and save it to a class library file (.VCX). You can even add your custom classes to FoxPro's Controls toolbar, so you can easily drag and drop your custom classes in the Form Designer just as you would with standard controls.

FoxPro's Form Designer now lets you drag and drop controls and set form properties via a tabbed Property Window. Gone are the various code snippets and the screen code generator familiar to users of FoxPro, Version 2.6.

Developers will also like the new Grid and Page Frame controls. The Grid control is like a Browse window, with rows and columns of data that can be manipulated through cells, but it is programmable. You can place controls like check boxes or buttons in a column. Creating one-to-many forms is easier now because

Continues on page 39

PowerPC Systems

Continued from page 37

nal cache. And playing up its focus on the power user, the Power Series 850 has room for 192MB of memory (our test system contained 32MB of RAM). The unit's motherboard has an S3 864 video chip, but for testing we used the optional PCI-based Diamond Javelin video board, which uses the Weitek 9100 graphics accelerator and 2MB VRAM.

MINI-TOWER OF POWER: *The Motorola PowerStack points the way for future networking and SCSI interface connections.*

There are a few extras on the IBM system, such as its vivid 17-inch 17s/s monitor, which has built-in speakers. The monitor has a small notch cut out of its top-left corner that can house a video camera for video conferencing. In addition, the system welcomes you with a CD-based video tour of the PC that complements the printed manuals. While business audio is standard on the system, it isn't compatible with the Sound Blaster standard.

The most intriguing aspect of the system is the ZIF processor socket on the motherboard. It can accommodate dual processing or an optional coprocessor in an expected future version.

DOES MOTOROLA STACK UP?

The gray tower case makes Motorola's PowerStack system look like any other PC from the outside, but inside, there's a major difference. The PowerStack is based on a 100-MHz PPC 604 processor that lets high-end users tap into the performance potential of the PowerPC.

The PowerStack has three available drive bays and can accommodate three PCI cards and three ISA expansion cards on its riser. The system can hold up to 256MB of RAM in its eight SIMM sockets. Our unit came with 64MB of RAM, but for testing purposes, we used 32MB of memory. The PowerStack comes with a Cirrus Logic–based graphics subsystem, which we upgraded to the optional Number 9 GXE 64 Pro PCI adapter with 4MB VRAM. No monitor was included.

The PowerStack has an edge over the IBM Power Series in two areas: sound and SCSI. The system's installed Sound Blaster Pro 16 audio card provides a little extra flexibility compared with IBM's business audio. And, while it was not active on our test system, the PowerStack's 68-pin SCSI III connector supports fast-and-wide data transfers.

> **FIRST LOOKS PLUS**
>
> From September 5 through 8, you can go on-line to discuss PowerPC-based systems and software with executives from Apple, IBM, Motorola, and other companies, hosted by PC Magazine senior editor Brian Nadel and technical director Nick Stam. Type GO EXEC at any CompuServe ! prompt.

HEAD TO HEAD TO HEAD

We tested the IBM and Motorola PCs along with an Austin PowerPlay 604/100 system (First Looks, August 1995) using Word and Excel by timing how long it took each system to complete a series of automated tasks. We also included an AT&T Globalyst 730 that's powered by a Pentium/133 CPU for comparison purposes (First Looks, July 1995).

The bulk of the tests exercised the systems' integer-math abilities. Among the PowerPC systems, the Power Series 850 with a 133-MHz processor took the early lead. The IBM system was more than twice as fast as the Austin system and nearly 20 percent faster than the Motorola system on our Excel benchmark tests. Under Word testing, the margin between the IBM and Motorola grew to nearly 30 percent, with the Austin continuing to trail. The overall winner for these two mainstream applications was the AT&T system, which uses a Pentium/133 CPU.

The story was slightly different when we turned to graphics testing, which relies more on floating-point calculations. The IBM kept the lead, although it was rivaled by the AT&T system in tasks that mixed integer and floating-point operations. While the IBM system has the edge in raw performance, a Pentium-based PC provides the best bang for the buck for general use.

With a list price of $7,017, the IBM Power Series 850 should be available from aggressive IBM dealers and VARs for closer to $6,000. That's higher than the $4,850 Motorola is charging for the PowerStack system we tested, but the disparity disappears when you factor in the cost of the premium 17-inch monitor IBM includes.

Both IBM and Motorola have designed excellent PowerPC-based systems, but the verdict is still out as to whether these units can successfully compete in the desktop market. Until the PowerPC develops a stronger software personality, it will remain a platform in search of a purpose.

Personal Computer Power Series 850. *List price: With 133-MHz PowerPC 604 processor, 512K external cache, 32MB RAM, 1GB hard disk, quad-speed CD-ROM, 17-inch monitor, $7,017. IBM Power Personal Systems, Somers, NY; 800-472-7693; fax, 800-426-4329.*

Circle 431 on reader service card.

PowerStack RISC PC MT 604-100. *List price: With 100-MHz PowerPC 604 processor, 512K external cache, 64MB RAM, 1GB hard disk, quad-speed CD-ROM, $4,850. Motorola Computer Group, Tempe, AZ; 800-759-1107.*

Circle 430 on reader service card

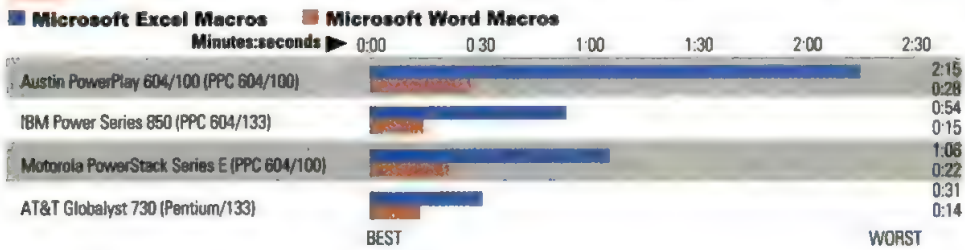
PERFORMANCE TESTS

PowerPC Systems

PC MAGAZINE LABS

The 133-MHz PowerPC–based IBM Power Series 850 had the advantage over its 100-MHz PowerPC competition, the Austin PowerPlay 604/100 and the Motorola PowerStack Series E. But the best performer was the AT&T Globalyst 730.

We used Microsoft Windows NT versions of Excel and Word to gauge the performance of these systems. Each PC was equipped with 32MB of RAM.

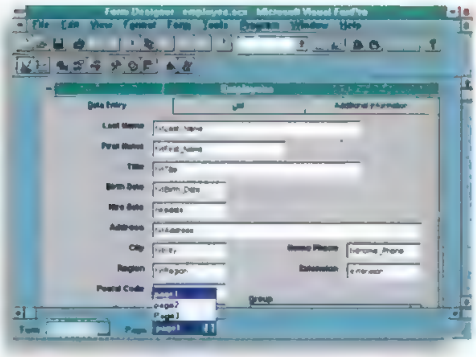


Visual FoxPro

Continued from page 37

you can use a Grid Control for the many-side of the relationship.

The new Page Frame control is the key to creating Forms that have many tabbed pages, such as the tabbed Options dialog boxes found in Microsoft Office applications. A page frame contains pages, and each page contains controls and data, making it like a form within a form.



EASY DIALOG: *The Form Designer supports the new Page Frame control, which makes creating tabbed dialog boxes a snap.*

FirstLooks Plus

From August 21 through 25, you can go on-line to download a demo and discuss Microsoft Visual FoxPro with product manager Jon Sigler and *PC Magazine* reviewer Sal Ricciardi. Type GO EXEC at any CompuServe ! prompt.

FoxPro exposes the Windows native-event loop so you can build truly event-driven applications. You can attach code to events such as Click, GotFocus, or Keypress. Developers can say goodbye to the tricks required to simulate an event-driven environment in prior versions of FoxPro.

One of the most difficult programming tasks in previous releases of FoxPro was creating multiple instance forms. FoxPro now handles the data synchronization issues better through data sessions, which create a separate but identical data environment for a form or form set. FoxPro then takes care of synchronizing the different data sessions.

The new release embraces the idea of using a database to organize and relate tables. Unlike Microsoft Access, however, FoxPro's new Database Container (.DBC) file doesn't actually contain the tables, which continue to be stored in external .DBF files.

The Database Container includes FoxPro's new data dictionary, which stores information about tables, fields, views, and relationships as well as providing the basis for automatic data integrity. Now you can set up field- and record-level validation rules and specify validation error text, field defaults, and field captions that are used automatically. You can also create triggers—code that is automatically started when values change.

With a database open, you can create persistent relationships by linking tables graphically using the Database Designer. The relationships are then used as default join conditions in the Query and View Designer and to store referential integrity (RI) information. You'll still use Set Relation for some nonpersistent conditions, however, since persistent relationships do not effect the record pointer.

We found that you can enforce RI using the RI Builder, which creates stored procedures (new to this release) and triggers to enforce referential integrity. FoxPro lets you create a real primary key index, and a true unique index that automatically rejects duplicates.

Visual FoxPro now supports local and remote updatable views. You can create named views using the View Designer and save them in your database. Local views become the basis for a client/server prototype, which can be converted later into a true client/server application by converting to remote views.

FoxPro also adds several SQL commands (alter table, update, and delete), support for NULL values, transactions, 18 Wizards, and builders for quickly creating controls, as well as new currency, date, time, and integer data types. What you won't find is an improved report writer; it hasn't changed much since Version 2.6.

Most developers will want the Professional Edition, which includes several OLE controls (Outline, MAPI, Comm, and Picture) and lets you compile your applications into .EXE files. Also included is a Class Browser, the Upsizing Wizard that turns your local prototype into a Microsoft SQL Server client/server application, and royalty-free distribution of finished applications.

Microsoft has positioned Visual FoxPro as a developer-only tool, placing it alongside Visual Basic in the company's application-development strategy. This puts FoxPro less in competition with Microsoft Access, which appeals to a broader audience of database users. All things considered, this is the best FoxPro yet.

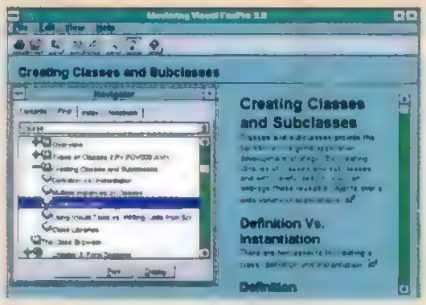
Microsoft Visual FoxPro 3.0 for Windows. *List price: Standard Edition $199; Professional Edition $49. Requires: 8MB of memory (12MB recommended), 15MB hard disk space, Microsoft Windows 3.1 or later or Windows NT 3.5 or later. Microsoft Corp., Redmond, Wa; 800-426-9400, 206-882-8080; fax, 206-936-7329.*

Circle 419 on reader service card

Easing the Transition to Objects

Visual FoxPro 3.0's many enhancements are welcome indeed, but the program's object-oriented way of doing things may be a shock to many FoxPro developers. To help with the transition, Microsoft is offering a $99 interactive CD-ROM training course: Mastering Microsoft Visual FoxPro 3.0. The product offers experienced developers an easy way to learn the ins and outs of Visual FoxPro.

The course content is made up of seven different elements. There's the actual course text organized into chapters; a collection of frequently asked questions; a library of sample source code used in the text; a collection of lab exercises; a glossary; a resource library; and a series of product demonstrations. These elements are intermingled throughout, and the source code examples are well placed in course text. You can always get to the sample source code through the outline-oriented navigator window.



CD TUTOR: *The Mastering Microsoft Visual FoxPro CD-ROM course provides interactive database training.*

Multimedia elements such as video clips, graphics, tables, and animated demonstrations are spread evenly throughout and accessed through icons. Also included are Lab exercises and Self-Check questions designed to prepare you for the Microsoft Certified Professional exam.

The course material is more task-oriented than FoxPro's printed documentation, and you can use the Navigator's Find or Index tabs to locate specific information quickly. You can use the many "See also" references to jump to related material or create personal bookmarks to return quickly to your favorite topics.

While not meant for beginning Xbase programmers, Mastering Microsoft Visual FoxPro looks like it will be a winning investment for experienced developers.—*SR*

MACINTOSH SYSTEMS

With PCI, Apple's Power Mac 9500 Takes a Giant Step Toward the PC World

By Sebastian Rupley

With its new Power Macintosh 9500/132, Apple has raised the bar for high-end systems. Despite its name, the 9500/132 system features a 133-MHz PowerPC 604 chip that should be competitive with Intel's upcoming P6 processor. Microprocessor semantics aside, the Power Mac 9500 uses two PCI buses and Apple's new System 7.5.2 operating system. As the first of a new generation of Macintosh systems that can take advantage of PCI-based peripherals, the Power Mac 9500 provides more bang for the buck and more choices than Apple's previous flagship system, the Power Mac 8100.

Based on outward appearances, the Power Mac 9500 and 8100 systems look very much alike, although the Power Mac 9500 is a few inches taller. Underneath the skin, however, they are quite different. While the 8100 uses a PowerPC 601 processor running at 110 MHz, the 9500 system uses a 133-MHz PowerPC 604 CPU.

POWER BUS

The Power Mac 9500 also replaces the Apple-standard NuBus architecture with a pair of PCI buses. Each independent PCI bus connects to three slots through a dedicated PCI bridge controller chip. PCI throughput is approximately 100 megabits per second, which is competitive with PC-based PCI implementations.

Standardization on the PCI bus means more than an increase in raw data throughput. Apple systems, including the Power Mac 9500, can now benefit from less expensive standard peripherals that were previously available only on the PC platform.

GRAPHICS ROCKET: *Apple's Power Mac 9500 uses industry-standard PCI architecture and 4MB of VRAM to produce state-of-the-art graphics performance.*

The Power Mac 9500/132 comes housed in a mini-tower case. Our test system, which sells for $5,799, was equipped with 16MB of RAM, 512K of external cache, a 2GB hard disk, a quad-speed Apple 600i CD-ROM drive, and an ATI PCI graphics card with 4MB of VRAM. This level of video memory, which supports a top resolution of 1,152 by 870 pixels with 16.7 million colors, is the minimum a graphics professional would want; a 2MB VRAM graphics subsystem costs $249 less. As is the case with Apple pricing, no monitor is included in the system price.

The Ziff-Davis MacBench 2.0 benchmark tests revealed the Power Mac 9500 to be the top-performing Macintosh available. It was almost 50 percent faster than the Power Mac 8100 on processor-intensive tests, and it was more than twice as fast at video-intensive tasks.

The Power Mac 9500's quad-speed CD-ROM drive was significantly faster than the Power Mac 8100's dual-speed CD-ROM drive, and the 9500 was more than twice as fast as the 8100 at applying a variety of Adobe Photoshop filters. The newer PC's floating-point performance, essential for many high-end graphics tasks, was only marginally better than that of the Power Mac 8100.

Aside from its dual-PCI design, the Power Mac 9500 also breaks from previous Macintosh designs in other ways. The system's PowerPC 604 processor sits on a daughtercard that fits into a slot in the center of the motherboard, which facilitates upgrading to processors that run as fast as 150 MHz.

MEMORY MATTERS

The Power Mac 9500 has a dozen 168-pin DIMM (dual in-line memory module) sockets, which can accommodate up to 768MB of memory. While the more common SIMMs (single in-line memory modules) deliver data to the CPU 64 bits at a time, pairs of DIMMs can seamlessly interleave data to deliver it to the CPU 128 bits at a time.

At $5,799 in its standard configuration, the Power Mac 9500 is not the cheapest system around, but it isn't much more expensive than the Power Mac 8100 it replaces. Likewise, the Power Mac 9500 is on a par with the expected price tag for the first generation of Intel P6–based systems, which will compete with the 9500 as graphics workstations.

What's still missing is the PowerPC's software identity. If you spend most of your time using Photoshop or other applications that have been recompiled for the PowerPC CPU, then the Power Mac 9500 is the top-performing system you can get. However, if you want to mix and match all kinds of applications, a system based on a fast Pentium or this fall's P6 may offer similar performance and more software flexibility.

Still, the latest Power Mac demonstrates Apple's new commitment to industry standards such as PCI, and as a high-end graphics workhorse for native PowerPC apps, the Power Macintosh 9500 is a rocket.

Power Macintosh 9500/132. *List price: With 16MB of RAM, 512K external cache, 2GB hard disk, quad-speed CD-ROM drive, $5,799. Apple Computer Corp., Cupertino, CA; 800-538-9696, 408-996-1010; fax, 408-974-9974.*

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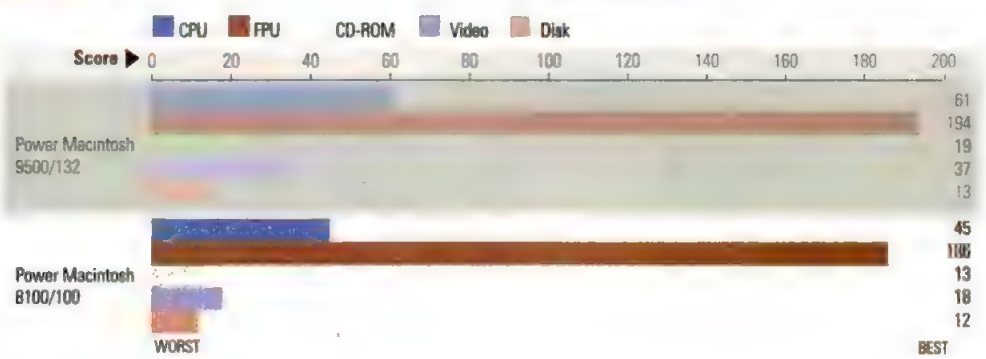
BENCHMARK TESTS

PC MAGAZINE LABS

Power Macintosh 9500/132

The Power Macintosh 9500/132 bested the Power Mac 8100/100 on all of our tests, although its floating-point and hard disk showings were only marginally better.

We used MacBench 2.0 to gauge the performance of each system's processor, floating-point unit, CD-ROM drive, video, and hard disk.



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ELECTRONIC PUBLISHING

Capture Balances Digital Publishing And Document Management

By Daniel Grotta & Sally Wiener Grotta

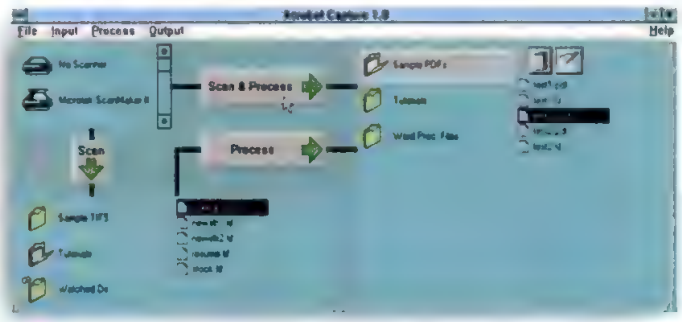
Traditional scanning software presents a tough choice for electronic publishers: Either use optical character recognition (OCR) to translate individual characters into an editable word processing file, or render the paper original as an image file. Adobe's $2,995 Acrobat Capture does both. What's more, when combined with Adobe's $500 Catalog program, Capture provides a complete professional document-management solution that rivals more expensive systems.

Acrobat works by scanning, automatically processing, and saving each original document as three separate files. The first file is in Acrobat's familiar .PDF (Portable Document File) format. This compressed cross-platform file retains fonts, color, and layout and allows for electronic distribution. While its contents may be searched and archived, the .PDF file can't be edited.

The second file Capture makes is in a compressed format called .ACD (Adobe Capture Document), in which text can be edited. The third is an uncompressed TIFF file. The key to Capture's usefulness is that any changes made to the .ACD document are automatically applied to the .PDF file.

You don't even need a scanner to use Capture, as the program can create the .PDF and .ACD files from any TIFF file. But with a scanner and sheet feeder, Capture can be set up for unattended scanning, processing, and filing of up to about 100 documents an hour. It's strongly recommended that you use 1 of the 22 scanners for which Adobe provides ISIS drivers. Although any Twain-compliant device will work, Capture will be able to scan only one document at a time.

Capture has a clean and intelligently designed interface that diagrams the workflow and shows where every active file is located. Just click on Scan & Process and the program automatically scans the document, producing the corresponding three files.



GO WITH THE FLOW: *Capture's interface shows what goes where.*

The interface shows exactly what is happening during the process. For example, every word that is recognized by the OCR software is shown in red. During testing, Capture was able to accurately recognize more than 99 percent of the contents of documents we scanned in at 300 dots per inch; this is better than most standalone OCR applications. On the downside, Capture doesn't do as well with faxes and photocopies, recognizing only 90 percent and 95 percent of the contents, respectively.

To proof and edit the document, click on the .ACD file, which brings up a subprogram called Capture Reviewer. Words that the program is uncertain about are displayed in yellow. Once finished, the edited .ACD file is saved, and all changes are automatically applied to the corresponding .PDF file.

As its hefty price tag implies, Capture is not for the casual desktop user. It's designed for those who routinely scan and store hundreds of documents a day and use the Acrobat Portable File Format. But considering all it does and how well it works, Capture is a good value for the price.

Acrobat Capture. *List price: $2,995. Requires: 16MB RAM, 15MB hard disk space, Microsoft Windows 3.1 or later. Adobe Systems Inc., Mountain View, CA; 800-833-6687, 415-961-4400; fax, 415-961-3769.*

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UTILITIES

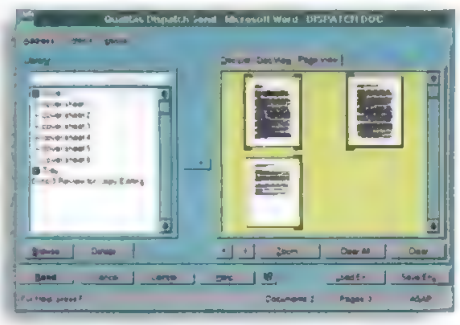
Dispatch: The PC's Document Distribution Center

By Gregg Keizer

Dispatch, Qualitas's $100 document traffic cop for your PC, can control the flow of documents to multiple recipients via a variety of media, including paper, fax, and electronic messaging. But the program is clunky at times, and it's a one-way system that doesn't allow you to retrieve e-mail or handle incoming faxes.

At the heart of Dispatch is its printer driver, which intercepts Print commands from any Windows application and then forwards the document to Dispatch for processing. The sender selects recipients from an address book, determines the distribution method for each, and either sends the document immediately or schedules it for later distribution. We were able to send a large and complicated test document to one recipient on a nearby printer, to a second via fax, and to a third using e-mail.

Dispatch uses your system's fax and e-mail apps for the actual distribution. Faxes are sent via FaxWorks or WinFax PRO; on-line e-mail is sent through CompuServe, the Internet, or MCI Mail; network mail is sent via cc:Mail, GroupWise, Lotus Notes, MHS Mail, or Microsoft Mail; and remote printing is done via any Windows printer on the network.



PREVIEW: *Dispatch shows thumbnail views of each document before you send it on its way.*

Assembling Dispatch's address book is the most tedious chore of the system. Fortunately, you can import existing address books from Act!, cc:Mail, GroupWise, Lotus Notes, MHS Mail, Microsoft Mail, NetWare Bindery files, and WinFax PRO. You can also set up multiple-recipient distribution groups.

Dispatch's toolbar can access the program's most-used components, including a log of what was sent. Dispatch is rife with overcrowded dialog boxes, however.

At times, Dispatch feels disjointed and unfinished. We required two replacement files before the program would work properly with MCI Mail and CompuServe, and both methods can distribute plain-text files only. Multiple-recipient faxing is slow, and you can't distribute using the TCP/IP protocol or over a dial-up connection using Winsock.

If you need to distribute a lot of documents to an extensive list over a variety of methods, Dispatch makes the connection.

Qualitas Dispatch. *List price: $99.95. Requires 4MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later. Qualitas Inc., Bethesda MD; 800-827-0486, 301-907-6700; fax, 301-718-6060.*

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PIMs

Ecco Professional 3.0: The Internet Information Organizer

By Gregg Keizer

NetManage's $175 Ecco Professional 3.0 remains the PIM for power users, combining flexible techniques for organizing and cross-referencing data from a variety of sources—including snippets of information picked up on the Internet. While the refined interface and enhancements make the program more accessible, Ecco 3.0 remains hard to master for the newcomer.

Ecco 3.0 continues to treat each piece of data as a separate item in a hierarchical outline. You can use the program's sophisticated filters and columns to store, display, and cross-reference information. Freeform notes are entered in Notepads (called Outlines in previous versions of the program) that—once mastered—are an excellent way to handle unstructured data.

FIRST LOOKS PLUS

From August 28 through September 1, join reviewer Greg Keizer and Ecco product manager Norma McKinney for an on-line discussion of Ecco Professional 3.0. Type GO EXEC at any CompuServe ! prompt.

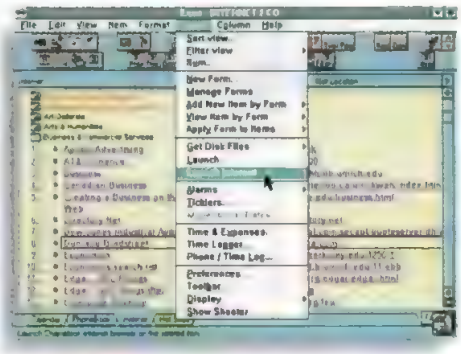
Ecco 3.0's Internet launch tool is a powerful feature for those who use the Internet as a source of information. Select an item showing a URL address and Ecco 3.0 automatically launches your Web browser to that site. Highlight the information you want and Ecco 3.0's Shooter will collect and move it into the program or any Windows application.

The program comes with an Internet address book of over 2,000 World-Wide Web sites. You can also create a rules-based system for automatically depositing items into folders. Rules are folder-specific; you have to recreate the rule manually for each folder that you want an item to drop into.

Ecco 3.0 includes sophisticated links to Ami Pro, Microsoft Word 6.0, and WordPerfect for Windows. A new query-by-form tool significantly improves searching, but you can't save these queries.

Ecco's look has also changed. The program uses a ringed-binder metaphor, with tabs at the bottom of the screen for each available Notepad; a right mouse click incorporates that outline into the present screen. As many as four outlines can appear on-screen simultaneously, and you can drag-and-drop items among them. The calendar now offers a yearly view, and you can add a three-month miniature calendar to daily, weekly, or monthly views.

Ecco 3.0 is a solid workgroup PIM that includes strong data sharing, file synchronization, and group-scheduling tools. But as good as it is at times, it can be just as quirky as its predecessors. Ecco 3.0 relies heavily on the mouse; common tasks such as dialing a phone number take an inordinate number of keystrokes; and the menu structure may befuddle beginners.



CLICK AND SURF: *Ecco's Internet launch button opens your Web browser to the URL selected.*

Current users will find much to love about Ecco Professional 3.0 and should jump at this update. New users in search of a powerful PIM should look no further.

Ecco Professional 3.0. *List price: $175 (upgrade, $49.95). Requires: 4MB RAM (8MB recommended), 11MB hard disk space, Microsoft Windows 3.1 or later. NetManage, Ecco Division, Bellevue, WA; 206-885-4272; fax, 206-885-0297.*

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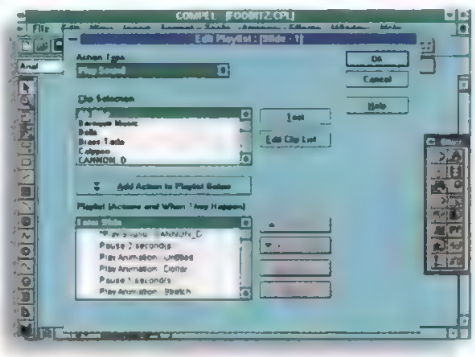
PRESENTATION GRAPHICS

Compel 2.0: The Easy Route to Multimedia

By David Haskin

Asymtrix's Compel, the first presentation graphics program to bring sophisticated multimedia capabilities to business presentations, just got a lot better. This long-awaited upgrade to Version 2.0 simplifies basic presentation creation and, at $69.95, is a multimedia bargain.



PLAY IT AGAIN SAMP: *Compel's Playlist scripts the entrance and exit of on-screen objects.*

Compel 2.0 now includes an outliner and a spell-checker. Asymetrix has also added task-automation dialog boxes, called Specialists, that walk you through some of the heavy-duty chores involved in creating presentations. One Specialist, similar to PowerPoint's AutoContent Wizard, lets you select a subject, and then the Compel Specialist creates a presentation with dummy text that you replace with your own.

Compel includes built-in video, animation, sound, and music players. The program also has extensive object animation capabilities in which you set the on-screen entry and exit paths for items like images and text. But you must wade through several levels of dialog boxes to set up and fine-tune a presentation's flow. Uniquely, Compel lets you make animated objects grow larger or smaller during a sequence.

To time precisely when each element in a slide enters and exits, you use a dialog box to create a Playlist, or script, of all slide elements and set the order in which their actions occur. Confusingly, though, items like an animated text heading-don't appear automatically on the Playlist. Other multimedia presentations use simpler time lines with slider bars and automatically add a slider bar to the interface for each object.

Compel's charting capabilities are weak compared with those of mainstream programs like PowerPoint but are similar to the ones in programs like Macromedia's Action! and Gold Disk's Astound. Compel provides fewer than 30 chart types and formatting options, which is adequate but not particularly rich. Moreover, Compel can't animate chart elements like the filling of bars or pie slices, a capability found in Action! and Astound.

Performance was sluggish at times. The program was very slow on our 90-MHz Pentium test system with 16MB of RAM when showing slides at 1,280-by-1,024 resolution. Unlike many presentation programs, Compel doesn't offer a faster black-and-white mode for viewing slides.

Even if it's sometimes clumsy and slow, Compel provides the power necessary for creating on-screen multimedia presentations. At $69.95, Compel provides a lot of multimedia bang for the buck.

Compel 2.0. *List price: $69.95. Requires: 4MB RAM, 8MB disk space, Microsoft Windows 3.1 or later. Asymetrix Corp., Bellevue, WA; 800-448-6543, 206-452-0501; fax, 206-637-1650.*

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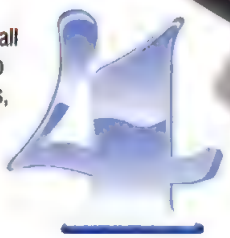

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IMAGE EDITING

MediaStudio Pro Handles All Your Multimedia Needs

By Daniel Grotta & Sally Wiener Grotta

There's a lot to like about Ulead Systems' $349 MediaStudio Pro. This one-stop image-editing program provides all the basic authoring and editing tools you need to create, script, and edit just about any multimedia presentation. What's more, MediaStudio Pro's individual components—image and video editing, screen capture, animation, morphing, and audio editing—are each strong enough to be used as standalone applications for most basic multimedia tasks.

The best thing about MediaStudio Pro is that all of its parts are well integrated into an easy-to-use whole. Often, users who piece together a multimedia presentation from files created in several different programs may experience incompatibilities. MediaStudio Pro provides one common set of tools and commands and a single interface, so everything mixes easily.

Conversely, the worst thing about MediaStudio Pro is that although the package as a whole is well integrated, each individual component is generally weaker and more limited than competing standalone programs. Don't expect it to do the things that Elastic Reality, Photoshop, PowerPoint, or Premiere can do.

EASY ONE-STOP EDITING

Installation and setup are done from a CD-ROM and are virtually idiot-proof. There's an introductory overview that demonstrates the scope and power of the program, as well as quick and easy, can't-make-a-mistake tutorials for the program's major elements.

As multimedia programs go, MediaStudio Pro is relatively easy to learn and master. Your focal point is the Control Center, which launches each of the individual programs and utilities. Each program uses the familiar tabbed-notebook metaphor and has a Switch pull-down menu that lets you move effortlessly from one part of the MediaStudio package to another.

The file viewer utility, which supports and can convert to and from over 58 different formats, lets users quickly open and inspect image files. Also included on the program's CD-ROM are over 400MB of clip art, stock photos, sound and video clips, and a library of transitions and special-effects filters.

COMPLETE CONTROL: *The Control Center's notebook metaphor lets users access each of MediaStudio's components quickly.*

A major strength of MediaStudio Pro is its file converter utility, which uses a simple point-and-shoot interface to graphically display all important input and output options, such as file format, data type, subdirectory, and color depth. In addition, it allows users to convert several files at once, thereby automating a tedious and time-consuming job.

To keep track of everything, MediaStudio Pro's subprogram, Album, catalogs and manages all multimedia files. Album allows users to organize, assemble, and track audio, video, and image files. In addition to its function as a database, Album lets the user quickly browse thumbnails of various files.

The image-editing module has basic tools for manipulating, retouching, compositing, and color correcting images. Because the program is Twain-compliant, you can scan images directly into MediaStudio Pro.

The program can also open images directly from CD-ROMs and Photo CDs. Because its primary purpose is to create and perfect still photos for a multimedia presentation, MediaStudio Pro's output options are limited to whatever is available from the Windows setup.

One useful feature is a thumbnail window that lets you see how an effect will look before it is applied. One not-so-useful aspect of the package is its primitive text handling.

MediaStudio allows morphing and 3D effects, and is one of the easiest ways to add a 3D drop-shadow to a string of text. As with the program's image-editing section, there's a window for viewing thumbnails of morphs and 3D operations in stages. The program provides intuitive, easy-to-use tools and utilities for enhancing and controlling the effects.

ALL THINGS IN GOOD TIME: *The video editor lets you drag and drop video, special effects, transitions, and audio onto a timeline.*

MOVING SIGHTS AND SOUNDS

The timeline-based audio editor lets users lay down a virtually unlimited number of sound tracks. Regardless of their source (.AVI or .WAV files, a microphone, and the like), the files can be converted, edited, and mixed directly. The number of tools and special effects are extensive and they are not difficult to use.

MediaStudio Pro's sophisticated screen-capture capability can freeze and save any image displayed on the monitor, regardless of the program you happen to be in. If there is a shortcoming to the product's design, it is that there are many (perhaps too many) options and parameters available. While this variety may excite the graphics pro, it has the potential to confuse the novice.

GO TO THE VIDEOTAPE

If you have a frame-grabber board, MediaStudio Pro's Video Capture utility will allow you to capture video in real time from any source—regardless of whether you're after individual frames or a sequence. The video editor's interface is an intuitive timeline that uses simple drag-and-drop assembly of clips.

Load in your video file or files, select the transitions or special effects, add sound, and select the type of output desired. We found the video editor's try-it-and-see ("walkthrough") approach refreshingly easy yet powerful—especially when trying and applying special effects and transitions.

The ease, scope, and versatility of MediaStudio Pro are impressive, particularly in a $349 program. Despite its occasional limitations, it is well suited for professionals and nonprofessionals who need to create their own multimedia presentations.

MediaStudio Pro 2.0. *List price: $349; upgrade from 1.0, $99.95. Requires: 4MB RAM (8MB recommended), 20MB hard disk space, Microsoft Windows 3.1 or later, CD-ROM drive. Ulead Systems Inc., Torrance, CA; 800-858-5323, 310-523-9393; fax, 310-523-9399.*

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CIRCLE 213 ON READER SERVICE CARD

CD-ROM

Pioneer DRM-624X: CD Six Shooter

By Alfred Poor

Pioneer, the first manufacturer with a multi-CD changer, has leapfrogged the industry by introducing its latest six-CD quad-speed model, the $795 DRM-624X.

This system builds on the company's successful earlier external SCSI device that stacked a sextet of CDs in a magazine and shuffled among them. The DRM-624X adds a stereo headphone jack and a volume control on the front panel. The unit has DIP switches for SCSI ID and termination settings, and RCA jacks for stereo sound output.

Pioneer claims a data throughput of 670 kilobytes per second (KBps), a rate somewhere between quad-speed and six-speed drives; average seek time is a claimed 110 milliseconds (ms). In our tests using CDBench, the maximum transfer rate was 627 KBps, and the half-platter seek time was 259 ms. This was faster than the average for quad-speed drives (see "The Newest Spin on CD-ROM Drives," March 28, 1995), and with a higher data throughput, but slower than the first six-speed drives from NEC and Plextor we've seen (First Looks, June 27, 1995).

Pioneer rates the time the drive takes to remove one disk from the reader mechanism and move another one in at less than five seconds. In our tests, it took between seven and nine seconds to swap a disk and read the disk's directory.

The driver that comes with the unit assigns each CD in the magazine its own separate drive letter. In general, this is a convenient solution, since you can install your software to address the different disks individually by drive letter. But there are two potential problems with this approach. Computers that are connected to a variety of networks and drives may not have six drive letters available, which will require some remapping of the network drives. And some new games on multiple CDs expect to find subsequent disks in the game on the same drive as the first disk, so you'd still have to shuffle these CDs.

The DRM-624X's installation process was fairly straightforward, though there were some problems. The written documentation did not correctly describe the installation procedure for the installation software itself—though this won't pose much of an obstacle to an experienced user. The fact that we had difficulty getting the drive to work properly with some older SCSI-2 controllers was more of a concern; the software is designed to work with certain cards—such as those from Future Domain—or a card that uses an ASPI driver. We could not, however, get the unit to work with some of the ASPI cards we tried.

QUICK LOAD: *Pioneer's six-disk CD magazine keeps your favorite CDs ready for action.*

Once you clear the configuration hurdles, the DRM-624X is a tremendous time-saver: It can find and load a favorite CD in less time than most people take to remove one from a jewel box—and having six of your frequently used disks on-line makes them all the more useful.

DRM-624X. *List price: $795. Requires: SCSI host adapter. Pioneer New Media Technologies Inc., Long Beach, CA; 800-444-6784; 310-952-2111; fax, 310-952-2309.*

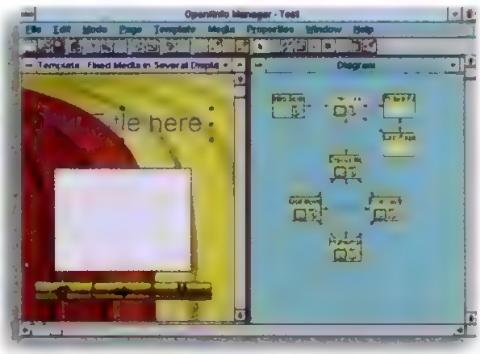
Circle 422 on reader service card

MULTIMEDIA AUTHORING

Open!Info Manager Makes Multimedia Happen

By Will Schleter

Horizons Technology's $299 Open!Info Manager 2.0 provides a simple, easy-to-use system for assembling and distributing interactive multimedia presentations. More than just a multimedia authoring system, Open!Info Manager features an object-oriented database to help you manage a variety of graphics, audio, video, animation, and text files. But don't expect any help in creating those myriad files; Open!Info Manager has no media creation, capture, or manipulation capabilities.



MAKING MULTIMEDIA: *Open!Info Manager uses a point-and-click interface for building standalone multimedia presentations.*

Some multimedia authoring systems require you to learn a scripting language to manage the flow of your presentation, as well as the user interaction. Open!Info Manager, like HSC Software's Interactive (First Looks, May 16, 1995), uses a point-and-click interface. All presentations are organized into pages, and any combination of seven types of controls—behavior, display, launch, list, movement, player, and text—can make up a page. A powerful template makes it easy to define multiple pages with common controls. The program includes 18 transition effects that let you crush, drip, explode, slide, spiral, or split the display when moving between pages.

Open!Info Manager opens virtually any type and format of multimedia data: graphics, video, animation, text, audio. With data in hand, you import information about the various files into Open!Info Manager's object-oriented database. While this imposes an extra step (you don't reference the files directly), the process does have an advantage: Descriptive names of up to 48 characters can be used for the objects. You can organize the data by file type and use multiple instances of objects—even across different presentations—without having duplicate files.

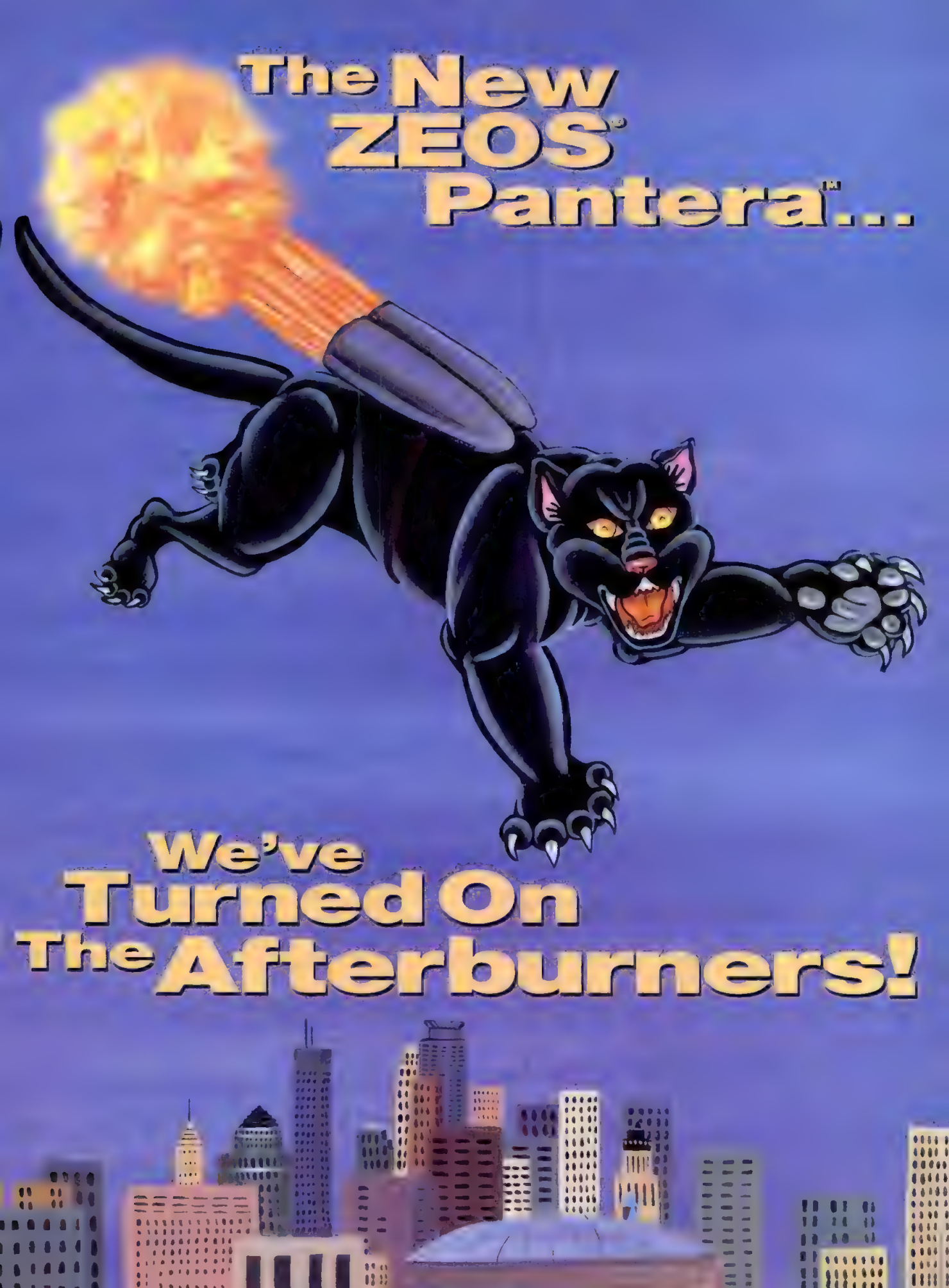
No media is embedded into the presentation, thus any component can be updated simply by replacing the appropriate file. A handy preview function allows you to start from any page and instantly preview the presentation.

Once your multimedia creation is complete, Open!Info Manager provides a powerful publish feature. The program automatically gathers all components into a single directory structure and generates a Windows setup program for installing the royalty-free viewer software, your presentation, and runtime versions of Video for Windows and QuickTime for Windows, if required.

If you already have the tools to generate your multimedia content, and need a simple, powerful, and easy-to-use multimedia authoring system, Open!Info Manager fits the bill. No programming or scripting means you have ease of use at the expense of flexibility, but enough built-in controls are provided to create impressive interactive standalone multimedia creations.

Open!Info Manager 2.0. *List price: $299. Requires: 4MB RAM (8MB recommended), 11MB hard disk space, CD-ROM drive, Microsoft Windows 3.1 or later. Horizons Technology Inc., San Diego, CA; 800-828-3808, 619-292-8831; fax, 619-292-7321.*

Circle 423 on reader service card


The New ZEOS® Pantera™...
We've Turned On The Afterburners!

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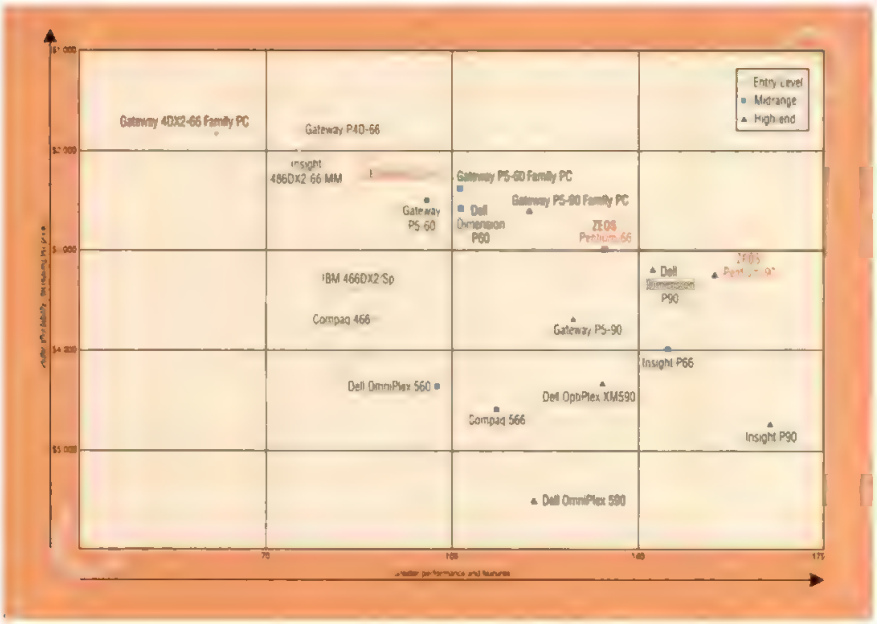
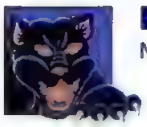
The Best...



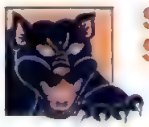
As *PC Magazine* and others report time after time, review after review, the ZEOS Pantera is your best value with its outstanding performance and incredibly low price.

Just Got Better!

Now, with these latest value-enhancing technologies, your Pentium™ processor-based ZEOS Pantera is even further in the lead.

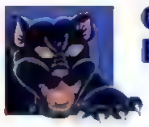


EDO DRAM: Memory access is now up to 33% faster!

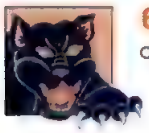


Synchronous Burst SRAM Cache: Cached data can now be accessed at up to double the usual speed!

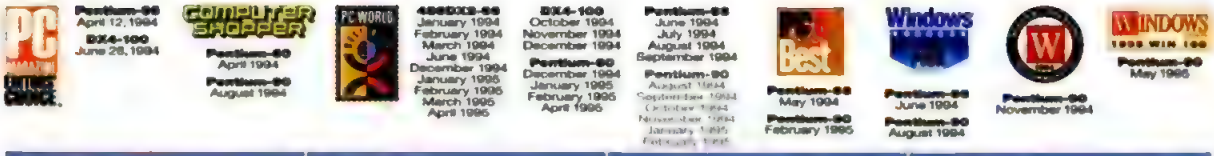
Upgradability to the P6-based OverDrive® Processor: You won't get caught short on cat-power with the Pantera. Upgradability to a future P6-based processor is built-in!



On-Board PCI Local Bus Ethernet and SCSI: Pentium processor-based Pantera systems allow the addition of local bus SCSI and networking right on the motherboard. That's lower cost and more expandability for you—but you can't get it from the other guys!



6 SIMM Slots: Expand all the way to 384MB! Plus, Pentium chip-based Pantera configurations all the way up to 128MB RAM leave free sockets for upgrading memory in the future. The others guys usually make you throw memory away before you can add more!



Package 1	Package 2	Package 3	Package 4
486 & DX4 Processor-based Panteras			
486DX2-66 $1295	486DX2-66 CN! $1695	486DX2-66 CN! $2095	486DX2-66 $2495
DX4-100 $1395	DX4-100 $1795	DX4-100 $2195	DX4-100 $2595
Pentium™ Processor-based Panteras			
75 MHz $1545	75 MHz CN! $1945	75 MHz CN! $2345	75 MHz $2745
90 MHz $1645	90 MHz $2045	90 MHz CN! $2445	90 MHz $2845
100 MHz $1795	100 MHz $2195	100 MHz $2595	100 MHz CN! $2995
120 MHz $1995	120 MHz $2395	120 MHz $2795	120 MHz CN! $3195
133 MHz $2145	133 MHz $2545	133 MHz $2945	133 MHz $3345
➤ 4MB RAM (Pentium processor-based Panteras include EDO RAM)	➤ 8MB RAM (Pentium processor-based Panteras include EDO RAM)	➤ 16MB RAM (Pentium processor-based Panteras include EDO RAM)	➤ 24MB RAM (Pentium processor-based Panteras include EDO RAM)
➤ **528MB** local bus EIDE hard drive, 14ms	➤ **850MB** local bus EIDE hard drive, 11ms	➤ **1GB** local bus EIDE hard drive, 12ms	➤ **1.2GB** local bus EIDE hard drive, 10ms
➤ 3.5" 1.44MB floppy disk drive	➤ **4X CD-ROM** drive and 3.5" 1.44MB floppy drive	➤ **4X CD-ROM** drive and 3.5" 1.44MB floppy drive	➤ **4X CD-ROM** drive and 3.5" 1.44MB floppy drive
➤ **Diamond Stealth 64** PCI local bus SVGA color graphics card with 1MB DRAM	➤ **Diamond Stealth 64** PCI local bus SVGA color graphics card with 1MB DRAM	➤ **Diamond Stealth 64** PCI local bus SVGA color graphics card with 1MB DRAM	➤ **Diamond Stealth 64** PCI local bus SVGA color graphics card with 1MB DRAM
➤ ZEOS 14" 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch	➤ **ZEOS 15"** 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch	➤ **ZEOS 15"** 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch	➤ **ZEOS 15"** 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch
➤ Six-bay desktop case with two cooling fans	➤ Six-bay desktop case with two cooling fans	➤ Six-bay desktop case with two cooling fans	➤ Six-bay desktop case with two cooling fans
➤ Microsoft Mouse	➤ Microsoft Mouse	➤ Microsoft Mouse	➤ Microsoft Mouse
➤ MS-DOS 6.2, Windows for Workgroups 3.11	➤ MS-DOS 6.2, Windows for Workgroups 3.11	➤ MS-DOS 6.2, Windows for Workgroups 3.11	➤ MS-DOS 6.2, Windows for Workgroups 3.11
➤ **MS Works**	➤ **MS Works Multimedia CD**	➤ **MS Office Pro & Bookshelf CD**	➤ **MS Office Pro & Bookshelf CD**

Included With Every ZEOS Pantera:

- ➤ Genuine Intel® Processor. ZIF socket for easy upgrading.
- ➤ Diamond Stealth PCI local bus color graphics card with 1MB DRAM, upgradable to 2MB DRAM.
- ➤ Flash BIOS for easy upgrading.
- ➤ Two high-speed serial ports and one enhanced parallel port on the motherboard.
- ➤ Slots: Three PCI & 4 ISA (486 processor), 3 PCI & 5 ISA (Pentium processor).
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- ➤ EPA Energy Star compliant.
- ➤ FCC Certified Class B; UL Listed.
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- ➤ RAM expandable to 128MB.

Pentium™ Processors:

- ➤ Upgradable to the future P6-based OverDrive® Processor.
- ➤ 6 SIMM slots for low-cost memory upgrading. EDO RAM expandable to 384MB.
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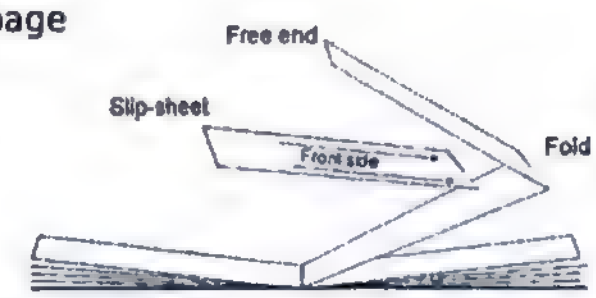
ZEOS

Folded edge of the page

GbsSlipSheet-001

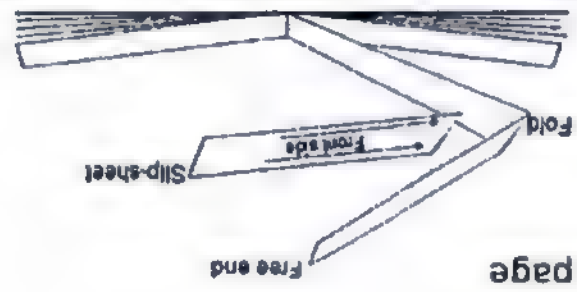
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

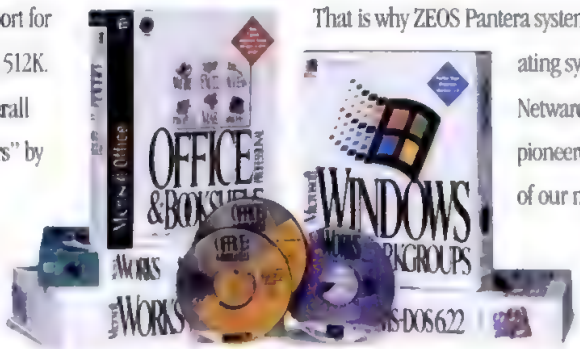
Pantera™ Strikes Again!

Keeping You In Front

The ZEOS Pantera, continuously rated the #1 value in PCs today, is flying ahead of the competition. Now ZEOS brings you all the features that have set the Pantera apart in the past *plus* new features that will keep you ahead of the pack in the future!

At ZEOS, our philosophy is to make sure that you, our customer, get the best of everything. And that starts with performance. The heart of the Pantera is a ZEOS-designed motherboard featuring PCI local bus expansion, on-board Enhanced IDE drive interfaces and support for SRAM caches up to 512K. Already called "Overall performance leaders" by *PC Magazine*, the Pentium™ processor-base Pantera line is now boosted even further with the addition of EDO DRAM, synchronous burst SRAM cache options and CPU choices all the way to the brand new 133MHz Pentium processor. In plain English, this all means that we've turned on the afterburners—giving you performance unlike anything you've seen before!

intel inside pentium PROCESSOR



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In addition to MS-DOS and Windows for Workgroups, ZEOS also gives you today's market leading applications software, loaded on your hard drive and ready to run, absolutely free! Microsoft® Works or Microsoft® Office Professional & Bookshelf are yours with your new ZEOS Pantera.

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energy EPA POLLUTION PREVENTER

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In addition to the latest features, you need your new system to arrive promptly and you need it to work in *your* environment when you get it. That is why ZEOS Pantera systems are compatible with every major operating system on the market including Win NT®, Netware®, Unix® and OS/2®. That is also why we pioneered our *Computers Now*® program—many of our most popular configurations can be shipped the *very day you order* (even custom-built systems can be shipped in about a week). You could be taking delivery of your new Pantera tomorrow!

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486DX2-66 $1695

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Package #2:
- 8MB RAM
- 850MB local bus EIDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64 PCI local bus graphics card/1MB DRAM
- 15" SVGA color monitor
- 6-bay desktop case
- MS-DOS, Windows for Workgroups, Microsoft® Mouse
- MS Works Multimedia CD

Pentium™ Processors
75 MHz $1995
90 MHz $2095

Discovery™ MM:
The above system modified to include:
- 8MB EDO RAM
- 528MB local bus EIDE hard drive
- Sound Blaster® 16 sound card, stereo speakers
- 14,400 bps send/receive fax modem

Pentium™ Processors
75 MHz $2545
90 MHz $2745
100 MHz $2895
120 MHz $3095

Hottest:
- 16MB EDO RAM, 256K synchronous SRAM cache
- 1GB local bus EIDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64 Video PCI local bus graphics card/2MB VRAM
- 15" SVGA color monitor
- 6-bay desktop case (75 MHz) 10-bay vertical case (90 MHz, 100 MHz & 120 MHz)
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- MS Office Pro & Bookshelf® CD

Pentium™ Processors
75 MHz $2945
100 MHz $3195
133 MHz $3545

Best MM:
- 16MB EDO RAM, 256K synchronous SRAM cache
- 850MB local bus EIDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- Sound Blaster® 16 sound card, high-power stereo speakers w/subwoofer
- Diamond Stealth 64 Video PCI local bus graphics card/2MB VRAM
- 17" SVGA color monitor
- 10-bay vertical case
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- MS Office Pro & Bookshelf CD

Pentium™ Processors
100 MHz $3745
120 MHz $3945
133 MHz $4095

Best MM Supreme:
The above system modified to include:
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- 1.2GB local bus EIDE hard drive
- High-power speakers w/ subwoofer

486DX2-66 $1345

Package #2:
- 8MB RAM, 256K SRAM cache
- 528MB hard drive
- 3.5" 1.44MB floppy drive
- VESA local bus SVGA color video
- 14" SVGA color monitor
- 4-bay desktop case
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- MS Works

DX4-100 $2795

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- 14.4 PCMCIA fax/modem
- 7.9" dual-scan color VGA display
- Custom leather carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- MS Works
- 7.8" x 10.2" x 1.7"; 4.1 lbs.

For active matrix display, add $700.

Pentium™ Processor
75MHz $4195

Package #3:
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- Internal 3.5" 1.44MB floppy drive
- Integrated 16-bit stereo sound
- External amplified speakers
- 14.4 PCMCIA fax/modem
- 10.3" dual-scan color SVGA display
- Custom nylon carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- MS Office Pro
- 8.9" x 11.7" x 2.1"; 6.8 lbs.

For active matrix display, add $800.

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*Orders must be for Computers Now! configurations, we've listed just a sampling here. Since we continuously update this list of configurations, please call to confirm your selection is on the list. This offer is good only as long as these pre-built systems remain in stock. Other ZEOS systems and custom configurations may take slightly longer - about a week. All orders are subject to credit approval. Monitor upgrades available on all desktop Computers Now! packages. Orders must be received by 1 p.m. Central Time. M-F.

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PRN PCM 9/95

CIRCLE 155 ON READER SERVICE CARD

FILE TRANSFER

AIRport 2000 Provides a Smooth Landing for Files

By Gregg Keizer

Adaptec's $119 AIRport 2000 makes clean work of file transfer between PCs by replacing cables with a wireless infrared (IR) link. With a range of up to 4 feet and excellent synchronization software, AIRport may be the easiest way to move files between PCs.

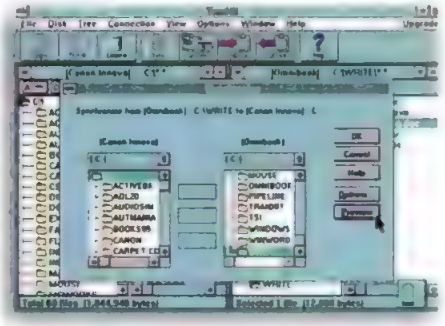
The AIRport system is compliant with the IrDA standard, which is the wireless protocol supported by notebook and printer makers. At just 3 by 4 by 1.5 inches (HWD), the AIRport adapter is about the size of a deck of cards and weighs less than half a pound. Connect it to a desktop PC's serial port and you're ready to go. A 5-foot-long cable stretches far enough to tuck the adapter out of the way.

The system comes with Puma Technologies' slick TranXit 1.1 file-transfer utility. Once it's installed on both machines, you can transfer individual files or entire directories by dragging and dropping icons on a File Manager–style split screen. TranXit does not allow you to print to an IrDA-compliant printer, however.

A connection is established between the sender and receiver systems almost automatically as long as the two PCs are within range. All you have to do is select the target machine from TranXit's list. TranXit includes synchronization options for updating machines at either end of the connection (or at both ends). You can even preview the file list before executing the synchronization command.

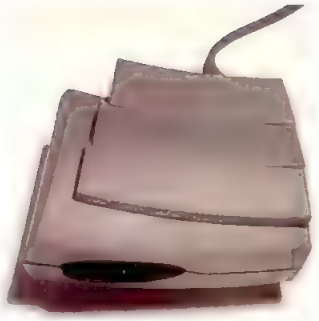
We tested AIRport with a Hewlett-Packard OmniBook 600c notebook. When the IR system was getting its power from the serial port, we found that AIRport had a transmission range of about 3 feet. According to Adaptec, when AIRport is powered by four AA batteries or the optional AC adapter the range is supposed to double, although we were unable to establish a reliable connection beyond 4 feet.

Adaptec claims that data-transfer speeds range from 9,600 bits per second (bps) to 115.2 Kbps. The distance between sender and receiver determines how fast data can flow between the PCs. Our top speed during testing was a respectable 67.7 Kbps when the notebook and AIRport were within inches of each other, but a much slower 48.6 Kbps when they were 3 feet apart. While this is a snail's pace for moving large files such as graphics images, it is plenty fast for moving typical documents.



TAKE OFF: *AIRport 2000 provides any PC with an infrared link. Its TranXit transfer utility lets you synchronize the contents of directories with a couple of clicks.*

At no time did we achieve the advertised 115.2-Kbps throughput. When the line of sight between systems was blocked for under 10 seconds, the transmission resumed on its own; longer breaks required starting over.



With its easy-to-install infrared adapter and superb file-transfer software, AIRport 2000 is a complete—and foolproof—wireless upgrade.

AIRport 2000. *List price: $119; Requires: 4MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later, free serial port on the desktop PC, IrDA-compliant system. Adaptec Inc., Milpitas, CA; 800-959-7274, 408-954-8600; fax, 408-262-2533.*

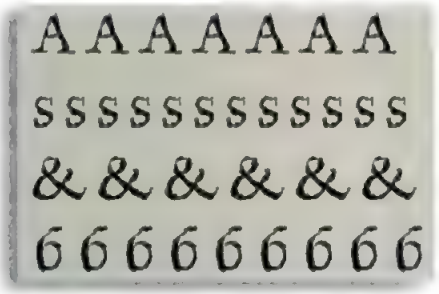
Circle 403 on reader service card

FONTS

Beowolf Fonts Mimic the Look of Metal Typography

By Edward Mendelson

FontShop's Beowolf series of PostScript typefaces are the first PC-based fonts designed with built-in random variations. These fonts, priced from $119 to $149 for each set of related designs, produce slight variations in the characters so that, for example, every capital A on the page looks slightly different from every other capital A. Beowolf performs this trick by using the randomization command built into the PostScript language, so it only works with PostScript printers.



HEAVY METAL: *Beowolf makes slight changes to fonts to imitate the look of hot metal type.*

Unlike metal type, which always has random variations based on the typeface's individual casting and wear, digital type is antiseptically regular. Some faces in the Beowolf series have so much built-in randomness that they look as if they melted on the page. Others in the series have subtle variations that you may not even notice if you aren't looking for them. Because the point at which the rasterizer starts printing the character is chosen within a small range of random variation, each letter appears at a slightly different height on the line. This vertical variation does a good imitation of metal type, in which the slugs are not perfectly aligned.

The series of typefaces consists of three families in FontShop's FontFont Line. The FF Beowolf ($119) is a serif face with sturdy, elegant proportions. It ships in the form of three roman fonts (no italics or bold) with different degrees of randomness. FF BeoSans Soft and FF BeoSans Hard ($149 each) are no-frills sans serif faces with increasing degrees of randomness; the BeoSans series comes with matching bold weights but no italics.

The Beowolf printer fonts are technically known as Type 3 PostScript fonts, and won't show the slight variations on your PC's monitor. To be able to show the type on-screen that approximates printed output, the installer loads matching Type 1 fonts into Adobe Type Manager. The Type 1 format doesn't support randomization, so the printed output will vary slightly from the screen display.

On the downside, the installer only works with the native Windows PostScript driver. If you want to use the fonts with the superior-quality Adobe PostScript driver, consult the instruction file, BEOWOLF.TXT, which is available in the First Looks Library on *PC Magazine*'s Editorial Forum on ZiffNet.

If today's digital typefaces are a little too perfect for your tastes, Beowolf injects some well-chosen randomness into your documents.

FF Beowolf Serif. *List price: $119. Requires: 4MB RAM, Microsoft Windows 3.1 or later, PostScript printer, Adobe Type Manager 2.02 or later. FontShop USA, Chicago, IL; 800 897-3872, 312-360-1990; fax, 312 360-1997.*

Circle 404 on reader service card

COLOR PRINTERS

Apple Color LaserWriter: Not Quite Ready for Prime Time

By Alfred Poor

The color laser printer market is getting crowded as all the major players get into the act. The latest entrant is the Color LaserWriter 12/600 PS from Apple Computer. While this initial release shows some rough edges, the system features advanced technology, and we feel that once Apple works out the bugs, the Color LaserWriter 12/600 PS will be a top candidate. But for now, incompatibilities and printing artifacts mar an otherwise excellent design.

The Color LaserWriter is capable of producing high-quality color images at speeds and per-page costs that put thermal wax transfer printers to shame. The machine is rated at 12 pages per minute for black and white, and three pages per minute for color. Color output at 600-dot-per-inch resolution is crisp, with well-saturated hues and nearly invisible dithering patterns. Unfortunately, the prints have noticeable banding.

The printer comes with 12MB of RAM standard. Thanks to Apple's Contone Compression Technology, this is sufficient to print up to a legal-size page of 600-dpi color; maximum memory is 40MB. The printer also includes Apple's Color Photo-Grade technology to further enhance color printouts. The printer's controller is driven by a 30-MHz AMD 29030 RISC processor, and the system supports the Adobe PostScript Level 2 command set. The Color LaserWriter for the PC comes with 39 fonts in ROM; Macintosh users get an additional 64 TrueType fonts on floppy disk.

Apple has made the Color LaserWriter as accessible to PC users as it is to Mac owners. In addition to the Apple LocalTalk port, the printer has Ethernet and bidirectional parallel ports. The parallel port uses the new high-density C-type connector, and Apple offers a cable as an extra-cost option.

Setup is relatively easy; there are four toner cartridges and an oil bottle to install. The engine uses monocomponent toner so you don't have separate developer units to fuss with. This reduces the number of consumables, but it also requires that the toner delivery system and the photoconductive drum be manufactured to more exacting tolerances.

The printer comes with a 250-sheet paper tray and a multipurpose tray that can hold up to 100 sheets of paper. You'll want some help setting up the printer, since it tips the scales at a bench-bending 110 pounds.

While most printer manufacturers have chosen to use random or diffusion halftoning patterns for their printers, Apple has stuck with the traditional line-screen approach for placing dots of color on paper. The key here is that the Apple print engine is capable of varying the intensity of the color (or black) for any given printed dot. The result is that the Color LaserWriter is able to produce multiple shades of each color at the dot level. This in turn makes it possible for the Apple engine to create more mixed shades with a given halftone pattern than traditional engines can.

With the exception of the banding artifacts that were present on our output, the printer created images that looked nearly as smooth as the output from a dye sublimation printer, and better than prints produced by the Tektronix Phaser 340 (First Looks, April 25, 1995).

The 600-dpi resolution also makes the printer a reasonable choice for black-and-white text output. Even under magnification, the Color LaserWriter's print samples looked sharp with almost no signs of aliasing. Apple

HOT ROCKS: *The Color LaserWriter12/600 PS's output produced vivid, realistic images—but also noticeable banding. The printer uses four color cartridges (see inset).*

Color Copy Shop On-Disk

If you have a Twain-compliant scanner and a printer, there may be times when you wish you had a simple way to make quick copies of the pages in your scanner. While many scanners now include utilities that provide some copy features, the new Mirror program from Expert Systems gives you a full copy shop on one disk—including the ability to do color work.

The Windows program has an interface that resembles a copy machine's control panel. Press the View button to preview the image on the screen. Other buttons let you choose options for the type of original, source and destination, and scaling. There are even image-quality settings for brightness, contrast, and tone balance.

You can get the original image directly from your scanner, use a stored file, or take the contents of any on-screen window. Output can be routed to your printer, saved as a file, or set up on your screen for viewing.

The program comes with 20 preset configurations for everything from duplicating a snapshot to capturing a Windows screen. While the program is designed to work primarily with color images, it also has settings that work well for black-and-white and gray-scale images.

Mirrors is a useful utility that makes the most of your scanner and printer.—*AP*

Mirrors. *List price: $79.95. Requires: 2MB RAM, 3MB hard disk space, Microsoft Windows 3.1 or later. Expert Systems Corp., Newport Beach, CA; 800-973-7810, 714-720-0950.*

Circle 432 on reader service card

estimates the print cost at just three cents per page for 5 percent coverage (typical for a page of text), which is on a par with black-only laser printers. At 20 percent page coverage—which is more indicative of graphics imaging—the per-page cost rises to 13 cents, according to Apple.

In our monochrome-text speed test, the system managed a rate of only 8.7 pages per minute, well short of the 12-ppm engine rating. The printer was, however, faster than the results indicate, as it had a tendency to pause for a noticeable length of time in the middle of our 20-page speed-test printout.

DRIVER PROBLEMS

Of more concern are the compatibility problems we encountered with the printer drivers. According to Apple, there are known problems with PCs that contain a Phoenix BIOS. When we replaced the Color LaserWriter driver with the Apple LaserWriter IINTX driver, the printer worked without problems.

After printing a few dozen pages, our test unit developed a defect that resulted in narrow light and dark bands appearing across the page in two places. Apple replaced the photoconductive drum, and the flaw disappeared.

In the coming months, more than 750 Kinko's Copy Centers throughout the U.S. will have Color LaserWriters available for customer use. This will give many business users an opportunity to try the color printer before they commit to its nearly $7,000 purchase price.

The Color LaserWriter has a suggested retail price of $6,989, which is competitive but not at the bottom of the range. For color photographs, this printer has the potential to produce the best-quality output of the current crop of color laser printers. But until some of the initial-release bugs get ironed out, you'll do best to wait a bit longer before buying one for yourself.

Apple Color LaserWriter 12/600 PS. *List price: With 12MB RAM, $6,989. Apple Computer Inc., Cupertino, CA; 800-538-9696, 408-966-1010.*

Circle 424 on reader service card

COLOR SCANNERS

Epson's ES-1000C: Affordable 30-Bit Color Scanning

By Rick Broida

The Epson ES-1000C flatbed scanner delivers 30-bit color capabilities similar to Hewlett-Packard's $1,179 ScanJet 3c—but for a few hundred dollars less. At $799, the Epson scanner is the least expensive route to high-quality digital images. That is, if your largest original is 8.5 by 11 inches.

Ironically, the toughest part about owning either the Epson or HP scanner is finding space for it on or near your desk. The ES-1000C's footprint is a desk-conquering 13 by 22.6 inches—about the same size as the ScanJet 3c. While the ScanJet's scan-bed is large enough for legal-size paper, the ES-1000C's holds only 8.5- by 11-inch originals.

EASY START . . .

Installing the ES-1000C involves little more than dropping the included Adaptec EZ-SCSI interface card into one of your PC's 16-bit expansion slots. The card is not jumperless, but the default settings worked fine on our testbed.

The real problem is the three-foot SCSI cable that comes with the scanner. It makes the ES-1000C virtually impossible to use with floor-standing tower systems. Fortunately, the scanner also comes with a parallel interface, so you can skip the SCSI interface altogether.

Inside the unit, a fluorescent tube provides an optical scanning resolution of 400 by 800 dots per inch. Software interpolation can boost that to 1,600 dpi. Conversely, the ScanJet 3c boasts a 600-dpi optical resolution, which HP software can hike to 2,400 dpi. Like many 30-bit scanners, the ES-1000C internally processes scans that are 10 bits per color channel, but externally produces 8-bit-per-channel images (or a total of 24-bit color).

. . . FAST FINISH

The ES-1000C took just 12 seconds to deliver a color preview of a full-page photo and 45 seconds to scan a four- by five-inch color image at 300 dpi. Both of these times are competitive with a variety of scanners costing several hundred dollars more.

After running Epson's one-time screen calibration utility, the ES-1000C produced excellent color, as sharp and vibrant as any scanner we've tested. While employing a single-pass mechanism, the ES-1000C has a three-pass mode for ultra-precise color scanning.

QUICK SCAN: *Epson's ES-1000C scanner can quickly turn a paper original into a full-color image.*

The unit also produced good gray-scale and line-art images. Although its limit of 256 gray levels is eclipsed by the ScanJet 3c's 1,024 levels, this scanner's monochrome abilities should suffice all but the graphics professional.

Epson's well-designed Twain driver features auto-scan capabilities and one-button controls for modifying contrast, saturation, gamma levels, and so forth. For color depth and scan resolution, you can choose one of the predefined image types and output destinations, or create your own. On the downside, the driver limits sizing to 50 percent reduction and 200 percent enlargement, and doesn't retain previously scanned images in its preview window.

Epson includes both Adobe Photoshop LE imaging editing and Xerox TextBridge optical character recognition (OCR) software. The scanner's Auto-Page Segmentation feature does a good job of separating text from graphics on a single page, while its Text Enhancement Technology improves OCR accuracy by reducing background noise. Options for the unit include a $499 30-sheet document feeder and a $799 transparency unit.

With its $799 estimated street price and exceptional 30-bit color scanning, the Epson ES-1000C would make a great addition to any desk. Any big desk, that is.

Epson ES-1000C. *Estimated street price: $799. Requires: 4MB RAM, available 16-bit expansion slot, Microsoft Windows 3.1 or later. Epson America Inc., Torrance, CA; 800-289-3776, ext. 3000, 310-782-0770.*

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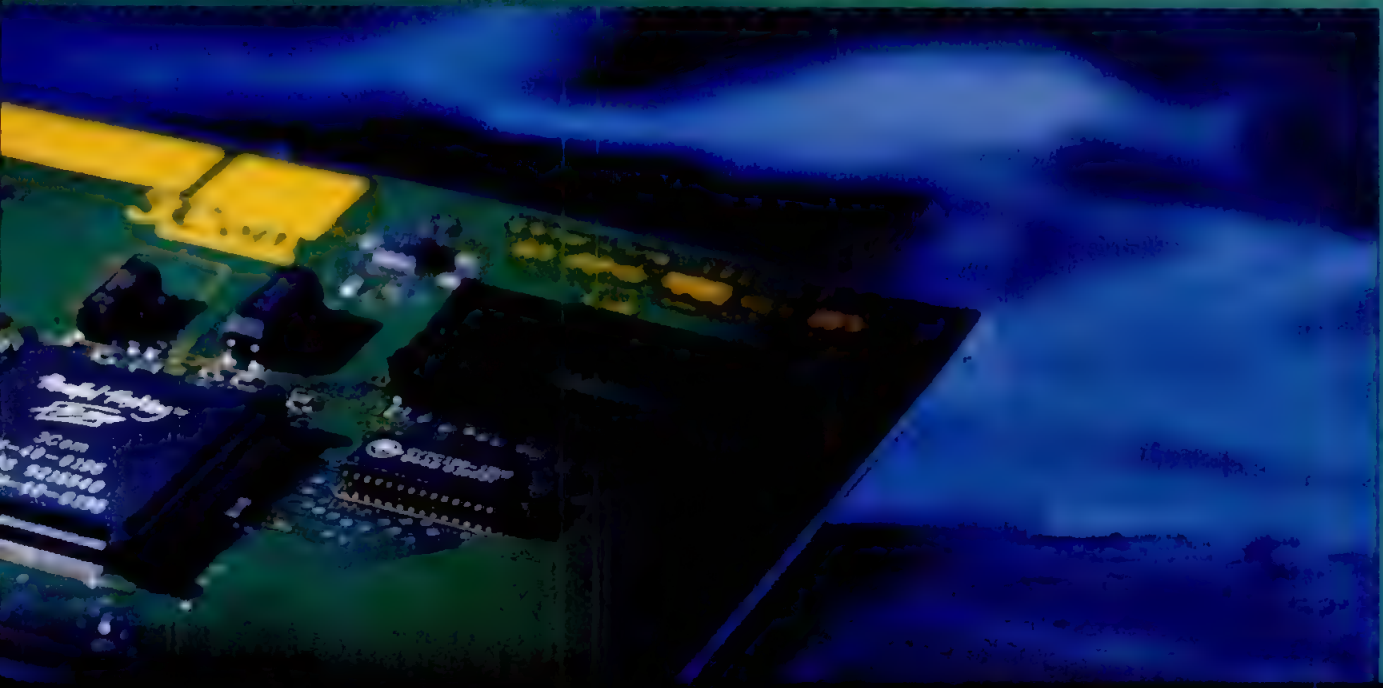

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CIRCLE 293 ON READER SERVICE CARD

DESKTOP PUBLISHING

With HTML, FrameMaker 5.0 Lets You Publish on the Web

By James Karney

While there are no dramatic changes in FrameMaker 5.0 for Windows, the program does have better graphic-design capabilities, more robust on-line publishing tools—including an HTML (Hypertext Markup Language) conversion utility—and a more intuitive user interface. This $895 package is an industrial-strength product for producing long and complex documents. It also lets you create on-line hypertext publications—including those for the World-Wide Web.

We used FrameMaker 5.0 under a variety of conditions to determine just how well it worked with design-intensive, complex, and on-line documents. We created a newsletter from scratch and a technical manual from existing word processing files (with added tables and equations); we also linked HTML Web pages with material from the manual.

WHAT'S INCLUDED . . .

Hypertext and electronic manuals have always been one of FrameMaker's strong points, and the program just keeps getting better. The structured tags that FrameMaker uses to format paragraphs and character blocks make documents well-suited for conversion to HTML. In addition, a runtime copy of Quadralay's WebWorks Publisher is included.

We exported several complex documents to Web pages by simply mapping the Frame tags to HTML and choosing Export from FrameMaker's File Menu. Our samples included tables and equations, which can cause problems. The new files worked perfectly with our NetScape browser. Another new output option is support for Adobe Acrobat, and the product ships with a copy of Adobe Type Manager. Missing from the list of export options is support for SGML; a FrameMaker version that supports SGML (Standard Generalized Markup Language) will be available soon (if you can't wait, see the sidebar on Microsoft SGML Author).

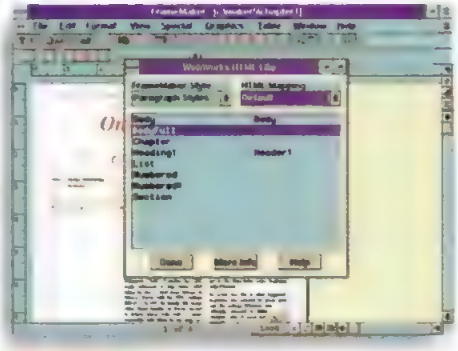
In a perfect world, on-line documents should be platform independent. While the world's not perfect, FrameMaker comes close. You can reference documents across a network, and draw from Windows, Unix, and Macintosh versions of the product. Although it is not yet certified for Windows NT, we had no problem running the program and sharing files on a network.

While FrameMaker still isn't as robust as QuarkXpress or PageMaker when it comes to handling graphics-intensive layout, its capabilities have been enhanced significantly. There is a new automatic text-wrap-around-graphics feature, as well as the ability to straddle headlines and tables over multiple columns on a page. You can place more than one image in a frame and align them via a well-thought-out dialog box. Frame Technology has gradually been improving FrameMaker's once cumbersome nested dialog boxes.

. . . AND WHAT'S MISSING

FrameMaker still lacks some of the fine placement controls found in QuarkXpress and PageMaker, but it beats those programs hands down when it comes to complex and long documents. You can link a number of files into a single document, and FrameMaker will automatically update all lists and cross references if you reorder them in the publication—without opening the individual documents. The CD-ROM product includes FrameReader, which lets you export a fully searchable, but read-only, hypertext edition of the final publication.

FrameMaker offers an excellent mix of features for handling complex documents and hypertext publishing. While it may not please those seeking a full design toolkit, FrameMaker offers features that facilitate creating long documents. When you couple these with the program's ease of use and cross-platform support, you have a product that stands apart from the competition.



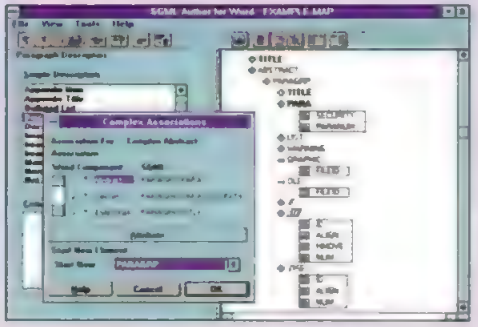
WEB-PAGE MAKER: *FrameMaker lets you easily create Web pages by mapping its tags to HTML.*

FrameMaker 5.0 for Windows. *List price: $895. Requires: 8MB RAM (12MB recommended), 20MB hard disk space, Microsoft Windows 3.1 or later. Frame Technology Corp., San Jose, CA; 800-843-7263, 408-433-3311; fax, 408-433-1928.*

Circle 420 on reader service card

SGML Author: No Training Required

SGML is becoming a major force in technical publishing and is the technology underlying the HTML used for Web home pages. Until now, however, most SGML editing systems required operators trained in this arcane but powerful tagging scheme. SGML Author for Windows, Microsoft's new $595 program, makes it easy for end users to author such documents.



TAG! YOU'RE LINKED: *Microsoft SGML Author uses SGML tags and a Word for Windows template to create a SGML document.*

You create text using a Word for Windows style-sheet template that matches the structure of SGML's Document Type Definition (DTD), then export a fully compliant SGML file. Validation of the finished publication is carried out by SGML Author's parser, so exported files will work on remote SGML systems. You'll still need an SGML-trained administrator to set up the style sheet and make sure it works with the DTD that relates to the publication. Microsoft provides the two most common DTDs with the program and many others are available in the public domain. (For more on SGML, see "Publish Without Paper," February 7, 1995.)

We found SGML Author easy to install and use. While most SGML software for Windows lacks support for equations and tables—elements that often occur in technical writing—SGML Author had no problems producing text, tables, and mathematics.

SGML Author moves the standard closer to the mainstream by letting users produce SGML materials with a traditional word processor.

Microsoft SGML Author for Windows. *List price: $595. Requires: 6MB RAM, 14MB hard disk space, Microsoft Windows 3.1 or later, Word for Windows 6.0 or later. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; fax, 206-936-7329.*

Circle 421 on reader service card

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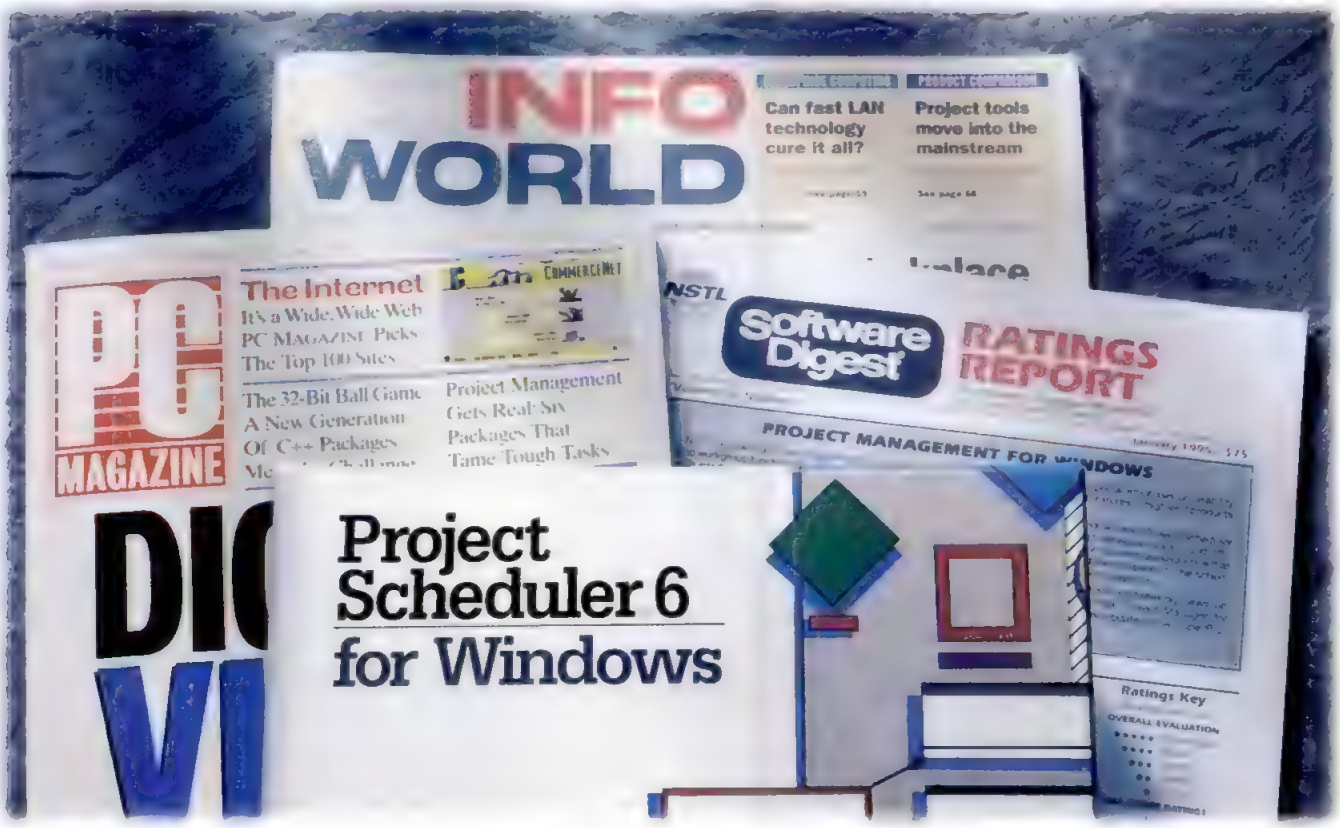

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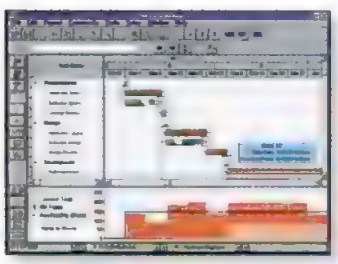

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[1]InfoWorld, October 3 1994 [2]PC Magazine April 11 1995 [3]Software Digest January 1995

MAPPING

Maptitude: Mapping Software with Low Hurdles

By Bruce Brown

If working with mapping software to help generate sales or assist serving your customers is in your future, Caliper Corp.'s Maptitude 3.0 is an easy and relatively inexpensive way to get started. The program's $395 price tag and comparative ease of use hold your dollar and time investments to a minimum, but can pay huge returns.

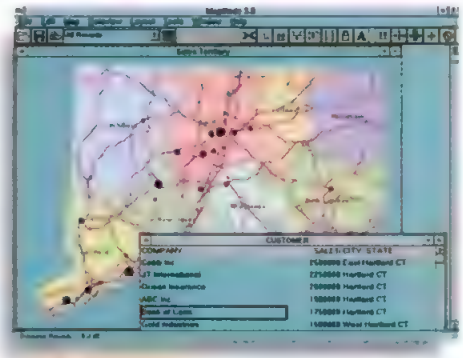
With its combination of mapping software, GIS (Geographic Information System) analysis tools, and an impressive geographic and demographic database, Maptitude can get you started right out of the box and keep you going. The key is the program's ability to use or link to data regardless of whether it's from Caliper, other GIS data providers, or your own geographically coded data sets.

You can create simple maps with Maptitude, using such features as address locators, landmarks, and a function to find the shortest or fastest routes with multiple stops. The program can also print directions.

The program's U.S. map-making functions alone justify the $395 price tag. When you add information to maps in removable and separately customizable layers, however, Maptitude really shows its depth. It's a tool for such data-intensive tasks as sales analyses by location, graphical geographic data presentation, and demographic analysis.

By adding your own data, you can get invaluable information about your business—such as how far your present customers are from one of your service centers, where prospective sales are located, or how various production sites are performing. You can give your maps a professional look with Maptitude's integrated layout and drawing tools, and you can access other data with the program's support for OLE 2.0 and ODBC database links.

Maptitude includes everything you'll need to get going, including the mapping engine, GIS analysis functions—with the capability to save queries and views—and two CD-ROMs, which contain data on U.S. streets, ZIP codes, political boundaries, and census information with common but extensive demographic data.



TREND-MONGERING: *By combining Maptitude 3.0's maps and highway data, you can present your information graphically.*

Maptitude's cost and ease of use compare favorably with the market leaders—MapInfo Corp.'s MapInfo (First Looks, December 20, 1994) and Wessex's First St. (First Looks, July 1995). Maptitude is much less expensive, especially considering that commonly used data sets are included in the package.

Maptitude's clearly written and amply illustrated manual includes a quick-start chapter, along with several 60-second tutorials for introducing new concepts. The more advanced program features require familarity with and juggling among several program functions, but learning to use Maptitude is no harder than figuring out how to manipulate spreadsheets or a basic database management program.

Maptitude 3.0 helps PC users without GIS backgrounds create sophisticated maps and analyze location-based data with relative ease. This is a program that you can use quickly for basic tasks and grow into for more advanced data analysis as your needs expand.

Maptitude 3.0. *List price: $395. Requires: 486 PC or better, 8MB RAM, 16MB hard disk space, CD-ROM drive, Microsoft Windows 3.1 or later. Caliper Corp., Newton, MA; 617-527-5700; fax, 617-527-5113.*

Circle 402 on reader service card

3-D GRAPHICS

3D Choreographer Makes Anyone an Animator

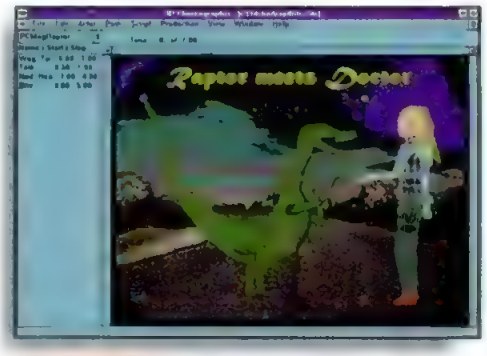
By Neil J. Rubenking

The hardest task in animation is making characters move realistically. AniCom's $149 3D Choreographer uses predesigned "actors" with hundreds of built-in actions, so even a beginner can create convincing animations immediately. Whether you are creating a business presentation or your own cartoon, 3D Choreographer provides a way to make believable animated sequences.

The beauty of 3D Choreographer is in how quickly you can get started. Place a backdrop bitmap, assemble and configure a cast of actors, give each a script of commands, and "rehearse" the animation with the actors displayed as wireframes. A less detailed stick-figure rehearsal mode is also available for PCs with slower processors. After a successful rehearsal, take a coffee break while the program renders a 256-color AutoDesk Animator .FLC file.

The basic package has over 50 actors, including a 3D alphabet, geometric shapes, men, women, and animals. Each actor responds to a wide variety of commands; the human actors are choreographed from a script of 200 actions, from raising an eyebrow or moving a finger to swimming or dancing. You specify the timing and number of repetitions for each command.

Nonconflicting actions can occur simultaneously; for example, a dinosaur can bite and wave its tail. You can also fine-tune a character's appearance, from nose shape to shoe color. Additional sets of characters for business and entertainment are available, and you can replace any actor with another compatible actor without rewriting the script.



MIX AND MATCH: *The velociraptor has been rendered with full shading, while the doctor has reverted to wireframe mode to cut rendering time.*

3D Choreographer's user interface could use a little streamlining, but it's easily learned. Look for a new version this winter that will handle more than 256 colors, support wrapping bitmaps on actors, and produce Video for Windows and QuickTime movies.

Even without the planned enhancements, 3D Choreographer is an easy and inexpensive way to add animation to business presentations or amuse your children with a personalized cartoon show.

3D Choreographer. *List price: $149. Requires: 4MB RAM, 20MB hard disk space, Microsoft Windows 3.1 or later, math coprocessor. AniCom Inc., Chapel Hill, NC; 800-949-4559, 919-967-2890; fax, 919-933-9503.*

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Point-and-Click Interface for Data Conversion and Migration	Yes	No	No
Integrated Query and Reporting	Yes	No	No
Built-in Full Featured SQL Database	Yes	No	Yes
Central Design Repository for Defining and Storing Extended Attributes	Yes	No	No
Full Object-Orientation, Including Inheritance of Visual and Non-Visual Objects	Yes	No	No
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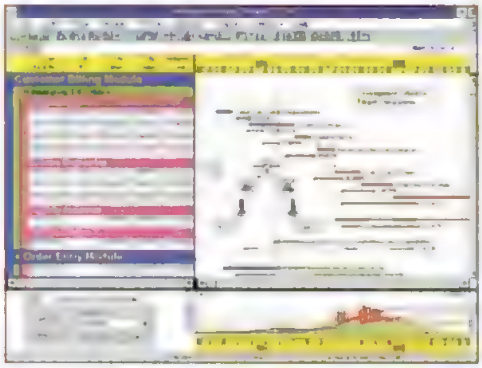

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CIRCLE 148 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Asa Somers

A Lack-Nothing Notebook

Packed tightly into a 7.3-pound box is the latest midrange portable notebook offering from **Toshiba America Information Systems,** and it seems the folks in R & D haven't missed a beat. The Satellite Pro 400 comes with a 75-MHz Pentium CPU, 8MB of EDO RAM, a 770MB hard disk, a 10.4-inch display, an infrared port, integrated 16-bit audio, and an internal power supply. A lithium-ion battery provides over 2 hours of use.

The Satellite Pro 400 comes in two configurations: the $4,899 400CDT, which comes with a TFT active-matrix display and a quad-speed CD-ROM drive that swaps out with the internal floppy disk drive; and the $4,199 400CS, which comes with passive-matrix display technology and includes only the floppy disk drive.

POWER ON THE ROAD: *The Satellite Pro 400 packs tons of features in a 7.3-pound box.*

Satellite Pro 400 series. *Estimated street price: 400CDT, $4,899; 400CS, $4,199. Toshiba America Information Systems, Irvine, CA; 800-334-3445.*

Circle 435 on reader service card

ReachOut Is Now Secure

Stac Electronics' ReachOut 5.0 remote-access software benefits from a significant increase in speed by incorporating LZS compression. Its SmartSend technology improves file transfers by sending only the portions of a file that have changed, reducing the time and cost of remote transfers. ReachOut 5.0's RapidSync option automatically synchronizes two machines, and the IntruderGuard feature, which constantly monitors for attempted break-ins, will shut out a user's account or even the host machine, if necessary.

ReachOut 5.0. *Estimated street price: $100. Stac Electronics, San Diego, CA; 619-794-4300; fax, 619-794-4570.*

Circle 406 on reader service card

Two Cellular V.34 PC Card Modems Hit the Streets

With a cellular phone and a laptop computer in hand, you can access your data from anywhere—and with these two new V.34-compatible PC Card modems from **Angia Communications** and **Simple Technology,** making the connection is easier and faster than ever.

Angia's $389 SafeJack (above, left) is a Type II PC Card. It features an adapter that plugs directly into the end of the card for making 28.8-Kbps connections over a standard phone line. For cellular transmissions, you simply replace the adapter with a $60 cable that plugs into your phone.

Angia has included another nice feature: SafeJack's landline adapter offers *two* RJ-11 jacks, one for a telephone line and one for daisy-chaining a telephone. You can alternate between phone calls and modem transmissions without having to plug and unplug the phone.

Now shipping from Simple Technology is the 28.8 Communicator (above, right), also a cellular-ready, V.34-compatible Type II PC Card. Beyond its fax and modem support, the $469 Communicator has telephony features built in so you can record an outgoing message and incoming calls and save them to disk. You can set up separate voice-mail boxes and even instruct the bundled software to page you when a call comes in. A cellular cable isn't cheap, though: You'll pay about $100 if you buy directly from Simple.

SafeJack. *List price: $389. Angia Communications, Provo, UT, 800-877-9159, 801-371-0488.*

Circle 433 on reader service card

28.8 Communicator. *List price: $469. Simple Technology, Santa Ana, CA, 800-367-7330, 714-476-1180.*

Circle 434 on reader service card

Meet USR's Multiple-Personality Modem

Designed to "ease the transition" from analog to digital communications, the Courier I-Modem from U.S. Robotics (USR) serves as both a V.34-compatible fax modem and an ISDN terminal adapter. Ranging from the $595 internal ISA card model (which requires an external NT-1) to the $895 external model (which comes with both an NT-1 and an analog device jack) the complete line of I-Modems lets you take full advantage of ISDN's increased bandwidth without forsaking analog compatability. Each modem ships with QuickLink II fax and data software.

Courier I-Modem. *List price: $595 to $895. U.S. Robotics, Skokie, IL; 800-877-2677.*

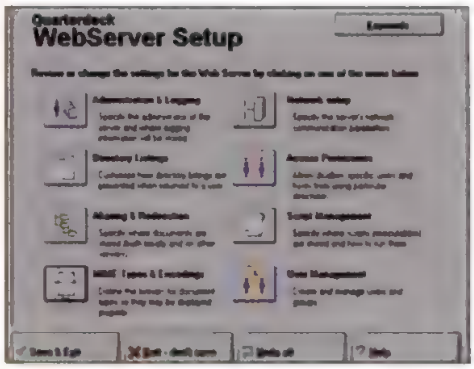
Circle 407 on reader service card

WebServer Runs in the Background

Quarterdeck Corp.'s 16-bit WebServer for Windows—designed to support migration to future 32-bit versions planned for Windows 95 and Windows NT—is a low-cost method for individual users or small companies to set up a site on the World-Wide Web. WebServer's multitasking engine manages up to 16 simultaneous document requests and 25,000 requests per hour on a 33-MHz 486. If you can't spare a dedicated machine, the product runs in the background; a minimized desktop icon indicates the server's status.

Quarterdeck WebServer for Windows. *List price: $130. Quarterdeck Corp., Santa Monica, CA; 310-392-9851; e-mail,* info@qdeck.com.

Circle 408 on reader service card



ON DECK: *The WebServer Setup screen gives you all the tools for managing your own Web page.*

Photography by Thom O'Connor

Desktop CD-R: Now an Affordable Option

Now hitting the market are two sub-$2,000 double-speed recordable CD-ROM (CD-R) drives from **Sony Electronics** and **MicroNet Technology**. Sony's $1,999 Spressa 920 is an internal model that fits into any 5.25-inch drive bay and supports a maximum sustained transfer rate of

DULY RECORDED: *The Spressa 920 (top) and the Master CD Plus (bottom) 2X CD-R drives.*

300 KBps. It features a 1MB data buffer and comes with Corel CD Creator software and three blank disks.

The $1,895 Master CD Plus from MicroNet is a half-height external drive that also comes with Corel's software and supports similar transfer speeds. MicroNet sells recordable disks for $25 each.

Spressa 920. *List price: $1,999. Sony Electronics Inc., San Jose, CA; 800-352-7669.*
Circle 409 on reader service card

Master CD Plus. *List price: $1,895. MicroNet Technology Inc., Irvine, CA; 714-453-6100; fax, 714-453-6101.*
Circle 410 on reader service card

Wildcat Provides BBS Billing and Security

Mustang Software has developed wcBilling, an add-on utility for use with the new $129 Version 4.11 of Wildcat, Mustang's bulletin board system (BBS) software. With Wildcat 4.11 and the $149 wcBilling, a sysop can track callers' use of the BBS and bill them for itemized services or according to the length of time they remain connected. Wildcat 4.11 now supports the MD5 secure password system, giving users a safer method of logging onto the BBS, and the product's message editor includes such enhancements as word wrap and spell-checking. Registered users can upgrade to Version 4.11 for $30.

Wildcat, Version 4.11. *List price: $129 to $999, depending on configuration.* **wcBilling.** *List price: $149. Mustang Software Inc., Bakersfield, CA; 800-999-9619, 805-873-2500; fax, 805-873-2599.*
Circle 411 on reader service card

SOFTWARE BRIEFS

Virtual Media Technology's $119 document-management package, Hypershelf, relies on a bookshelf metaphor for organizing files. An autoindexing feature lets you perform a full-text search across multiple documents, and only the most recent version of a document is made available to users. A 20-user version of the product costs $595; publisher licenses are available for larger numbers of users. 609-424-6565, 609-424-0785.

The first issue of **Marinex Multimedia**'s $9.95 CD-ROM–based men's magazine, Trouble & Attitude, shipped in May, featuring a cover story on the wildly popular "Baywatch" TV series. The next issue, scheduled to ship soon after you read this, will feature an article on Blue Note Records and a tour of the Florida offices of the *Weekly World News*. 800-676-8533; e-mail, *info@marinex.com*.

Bananas Software's Image'n'Bits 2.0 is a $79 OLE 2.0–based image-enhancement, screen-capture, and file-conversion package that lets you embed images and video clips in any OLE-compliant application and edit the files without leaving your curent app. The product features thumbnail support and high-end screen-capture functionality. 800-653-4624.

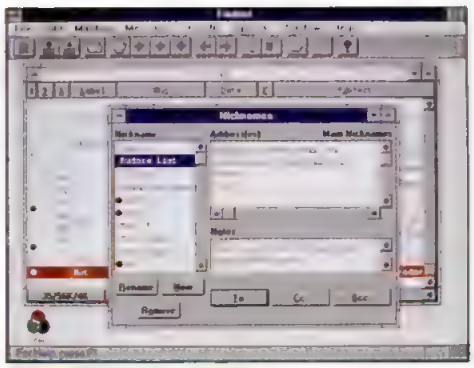
Designed with the nonartist in mind, **DeltaPoint**'s $149 Drag 'n Draw for Windows helps business users create technical drawings. The product features a number of SmartDrawing libraries, which contain thousands of graphics for use in your creations. You can copy any object to the Windows Clipboard and convert it into a SmartDrawing for use in Drag 'n Draw 800-446-6955.

Silanis Technology's $149 ApproveIT document-security package is not a handwriting-recognition tool. Rather, it treats handwritten, password-protected signature files as keys to attached documents. Should a document be altered by an unauthorized user, ApproveIT will not allow the document to be printed with its embedded signature. 514-369-4161.

Investors with a soft spot for mutual funds will want to check out Monocle from **Manhattan Analytics.** This $149 package lets you track, compare, and rank mutual funds and build your own investment strategy. You can download daily updates on 1,000 mutual funds directly from the company; Monocle will update your portfolio automatically. An annual subscription to this service costs $240. 800-251-3863

E-Mail: Qualcomm's Eudora Goes Pro

Qualcomm has recently introduced the latest version of its Internet electronic-mail package, now called Eudora Pro. This $89 release adds Frontier



WELL, YOU CAN CALL ME RAY. . . : *Use Eudora's nickname feature to abbreviate long user names.*

Technologies Corp.'s SuperTCP Kernel TCP/IP network connectivity software and comes with a 30-day free trial of the Portal Information Network's Internet connectivity service. Qualcomm has also integrated a spell-checker in this release.

Eudora Pro. *List price: $89. Qualcomm Inc., San Diego, CA; 800-238-3672, 615-658-1291; e-mail,* eudora-rep @qualcomm.com.
Circle 412 on reader service card

NEW & IMPROVED PLUS

You can download Eudora Light, a freeware version of Eudora from Library 3 of the Editorial forum on ZiffNet. Type GO EDITOR from any CompuServe ! prompt

GreenDesk Banishes Paper to the Past

Sadly, the paperless office is still years away, but **GreenSoft Corp.** has introduced a $49 software product called GreenDesk that helps you lessen your paper needs dramatically. GreenDesk is basically a document-management package that adds optical character recognition (OCR) and fax capabilities to its bag of tricks. The SmartTab Database allows for keyword and Boolean searches, and GreenDesk's faxing module lets you compress faxes at up to 50:1 compression and file them in an intuitive folder system. GreenDesk supports Twain-compatible scanners and thumbnail views of scanned documents for easy filing.

GreenDesk. *List price: $49. GreenSoft Corp., Camarillo, CA; 800-588-3375, 805-388-1700; fax, 805-388-0660.*
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CIRCLE 102 ON READER SERVICE CARD

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Canon

Hit the Trail with Your Notebook in Tow

Memo to portable computer users lamenting the inconvenient and clunky laptop bags they're presently lugging around: Try **Outdoor Products'** good-looking BytePak. This $60 standard-size backpack is designed to carry a standard notebook computer securely in its padded main compartment, while a separate full-size and three smaller pockets can be used for books, a power

PACK IT IN: *The BytePak looks like a standard backpack optimized for carrying a laptop.*

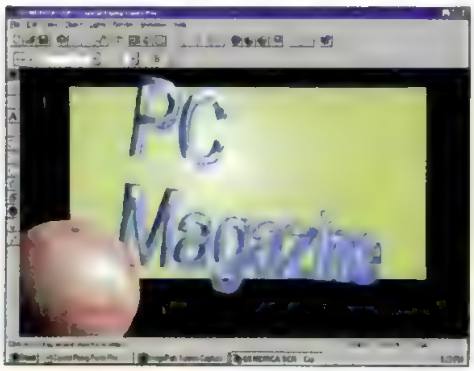
adapter, a printer—even camping equipment. The BytePak is made of durable waterproofed nylon that comes in burgundy, navy, teal, black, and purple—and it's guaranteed to give you that crunchy collegiate look.

BytePak. *List price: $60. Outdoor Products, Los Angeles, CA; 800-438-3353.*

Circle 413 on reader service card

Flying Fonts Pro: Text Takes to the Air

Version 3.0 of Flying Fonts Pro, from **CrystalGraphics,** features a number of enhancements designed to help you create professional-looking animated 3-D logos and titles. High-end videographers will appreciate the 32-bit frame-by-frame output of rendered sequences at resolutions of up to 8,000 by 8,000 pixels, field rendering, NTSC/PAL color correction, superblack support, and added support for TrueType fonts and 24-bit .AVI files.



LOOK! UP IN THE SKY!: *You can dynamically edit the motion path your flying font follows.*

You can now select from a menu of predefined motion paths, which can be edited easily using simple controls. A materials dialog box offers more than 50 textures, such as marble, gold, and wood, and a beveling dialog lets you use and modify 16 predefined bevel styles. Registered users can upgrade to Flying Fonts Pro 3.0 for $49.

Flying Fonts Pro 3.0 for Windows. *List price: $245. CrystalGraphics Inc., Santa Clara, CA; 800-979-3535; fax, 408-496-0970.*

Circle 415 on reader service card

HARDWARE BRIEFS

Raising the bar yet again for the highest of high-end laptop computers, **Tadpole Technology** has introduced the latest in its Tadpole 1000 series, the 133-MHz Pentium-based P1300. This $6,995, 7.5-pound notebook features a 10.4-inch active-matrix screen, 8MB of RAM (upgradable to 128MB), a 340MB removable hard disk (available up to 1.2GB), a 256K L2 cache, and integrated 16-bit audio. 800-232-6656.

New from **Radius** are two 21-inch high-resolution color displays: the $2,149 business-class MultiView 21 and the $2,749 PrecisionView 21 for publishing professionals. Both models handle resolutions of up to 1,600 by 1,200, offer plug-and-play capabilities, and feature on-screen display controls. The MultiView features a 0.25-mm dot-pitch Invar shadow mask CRT, and the PrecisionView comes with a 0.30mm aperture grill pitch and high-end color controls. 415-363-0982.

Plustek USA has introduced the Twain-compliant PageReader 800, an 800-dpi gray-scale page scanner that's only slightly larger than a three-hole punch in size and weighs less than 2 pounds. At 200 dpi, the PageReader can scan at 6 pages per minute. It ships with a multilanguage OCR software package. 800-685-8000.

Intended to work with HP LaserJet II– and III–compatible printers, the QS2000 toner cartridge from **Advanced Toner Technology** produces from 12 to 15 thousand pages on a single charge. Designed to be recycled, the QS2000 features stainless-steel moving parts and can be recharged for $65. A new QS2000 costs $175. 800-230-1287.

For $39, you can purchase a single SimmStack device from **Sermax Corp.** in order to expand your computer's capacity for SIMMs. The SimmStack Converter model allows you to plug four 30-pin SIMMs into a single 72-pin slot, and the Doubler model converts a single 72-pin slot into two 72-pin slots. 212-410-1597.

AND FINALLY...

Often available for up to 50 percent less than nonrecycled disks, GreenDisks from **GreenDisk Inc.** are recycled and reformatted high-quality floppy disks culled from software companies' unsold, obsolete inventories. You can get a ten-pack of GreenDisks on the street for under $6. 800-305-3475.

Power-Protection Pair

In the event of a power surge or outage, it's nice to know you have protection. Two new series of UPSs from **Optiquest** and **American Power Conversion** (APC) give you peace of mind.

Optiquest's Opti-UPS Series E models, in conjunction with the $99 Opti-Safe+ software, let you monitor I/O voltage, AC frequency, battery status, and percent load. You can run a self test, and when a power failure occurs, Opti-Safe+ alerts network users to save their work (and will even notify users via pager). The models also feature hot-swappable batteries and SNMP support.

TWICE THE PROTECTION: *The Opti-UPS E 420 (left) and APC's Back-UPS Pro (right).*

Available concurrent with the release of Windows 95 is APC's Back-UPS Pro series. These UPSs use PowerChute Pro software to perform unattended or scheduled system shutdowns, run diagnostic tests, and log power events. Most importantly, the UPSs are configured to be fully Plug N Play–compliant with Windows 95.

Opti-UPS series E. *List price: $139 to $299, depending on model. Optiquest Inc., Walnut, CA; 800-843-6784.*

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Back-UPS Pro. *List price: $239 to $419, depending on model. American Power Conversion, West Kingston, RI; 800-800-4272.*

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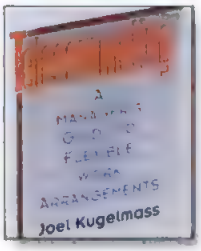
Edited by Tin Albano

Learning to Work at Home

BY BRUCE BROWN

If you plan and manage telecommuting correctly, the benefits can include increased employee productivity, lower office-space requirements, and the ability to enable people to meet changing family needs. *Telecommuting: A Manager's Guide to Flexible Work Arrangements*, by Joel Kugelmass, provides a thorough study of the societal and economic influences that have made telecommuting a factor in international and local companies.



Kugelmass's book is divided into two sections, "Understanding Flexible Work" and "Implementing Flexible Work." The first section considers the forces that have made telecommuting and flexible work arrangements attractive and even necessary for many businesses and institutions. The author gives ample attention to possible challenges to successful telecommuting (particularly resistance by middle managers who fear losing power) and the factors in choosing and managing telecommuters.

The "Implementing" section of the book is shorter than the "Understanding" section, but it provides a framework for setting up telecommuting policies, including a contract-like model Flexible Work Agreement, which outlines company expectations and policies regarding telecommuting arrangements.

Making Telecommuting Happen, a Guide for Telemanagers and Telecommuters, by Jack M. Nilles, combines an entertaining writing style with charts, graphics, and even cartoons. Nilles presents the advantages of and the obstacles to successful telecommuting, but he dives in quickly to practical, hands-on information intended to be used as reference material before, during, and after you set up a company's telecommuting plan. Drawing from the author's extensive national and international experience with telecommuting projects, this book is more a working guide than an academic discussion, though it does back up statements and claims with references to studies and company experiences.

Nilles includes checklists, model agreements, and other tools for implementing a plan. While his focus is on managing telecommuting plans—including performance expectations and rules and regulations—this book is also helpful for telecommuters who want the greatest success from their work arrangement.

Each of these books provides ample information and a helpful framework for telecommuting plans that meet the goals of both employees and employers.

Telecommuting: A Manager's Guide to Flexible Work Arrangements, *by Joel Kugelmass, $25.00. Lexington Books, 800-323-7445; ISBN: 0-02-917691-3.*

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Making Telecommuting Happen, a Guide for Telemanagers and Telecommuters, *by Jack M. Nilles, $24.95. Van Nostrand Reinhold, 800-842-3636; ISBN: 0-442-01857-6.*

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Deciphering Network Security

BY O. RYAN TABIBIAN

If you are saddled with the responsibility of securing your network or are interested in learning more about electronic security, then *Network Security, Private Communication in a Public World* will be a worthwhile read.

The book is grouped into three parts: "Cryptography," "Authentication," and "Electronic Mail." There is also a "Leftover" section, which covers security with popular network operating systems such as Microsoft Windows NT and NetWare. Each section of the book is cleverly laid out and very well organized, making it easy for the reader to follow.

Most books fail to cover the difficult subject of cryptography effectively. *Network Security,* however, clearly describes the different cryptography methods—such as secret key, hashing, and public-key cryptography—as well as a variety of other technologies, including Diffie-Hellman and RSA.

The second section, "Authentication," deals with how a system or persons you are communicating with can verify your identity. Verification schemes range from simple passwords to complex digital signatures. The authors do a remarkable job of describing and analyzing the variety of authentication methods.

Since the majority of your access to the outside world is through e-mail, your messages are probably most vulnerable. The book covers some of the popular e-mail security schemes, such as public key and privacy-enhanced mail. A brief overview of X.400 is also included.

Overall this is perhaps the most comprehensive, yet easiest-to-understand book covering network security available.

Network Security, Private Communication in a Public World, *by Charlie Kaufman, Radia Perlman, and Mike Speciner, $46.00. Prentice Hall PTR, 800-947-7700; ISBN: 0-13-061466-1*

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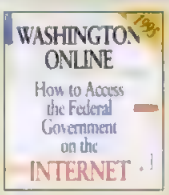

Bruce Maxwell's new book, *Washington Online: How to Access the Federal Government on the Internet,* picks up where his *Washington Online: How to Access the Government's Electronic Bulletin Boards* (Read Only, June 13, 1995) left off. In-depth descriptions and addresses of nearly 300 federal Internet sites and resources help draw a clearer map of our government's spur on the information highway. $19.95; Congressional Quarterly Books, 800-638-1710; ISBN: 1-56802-034-1.

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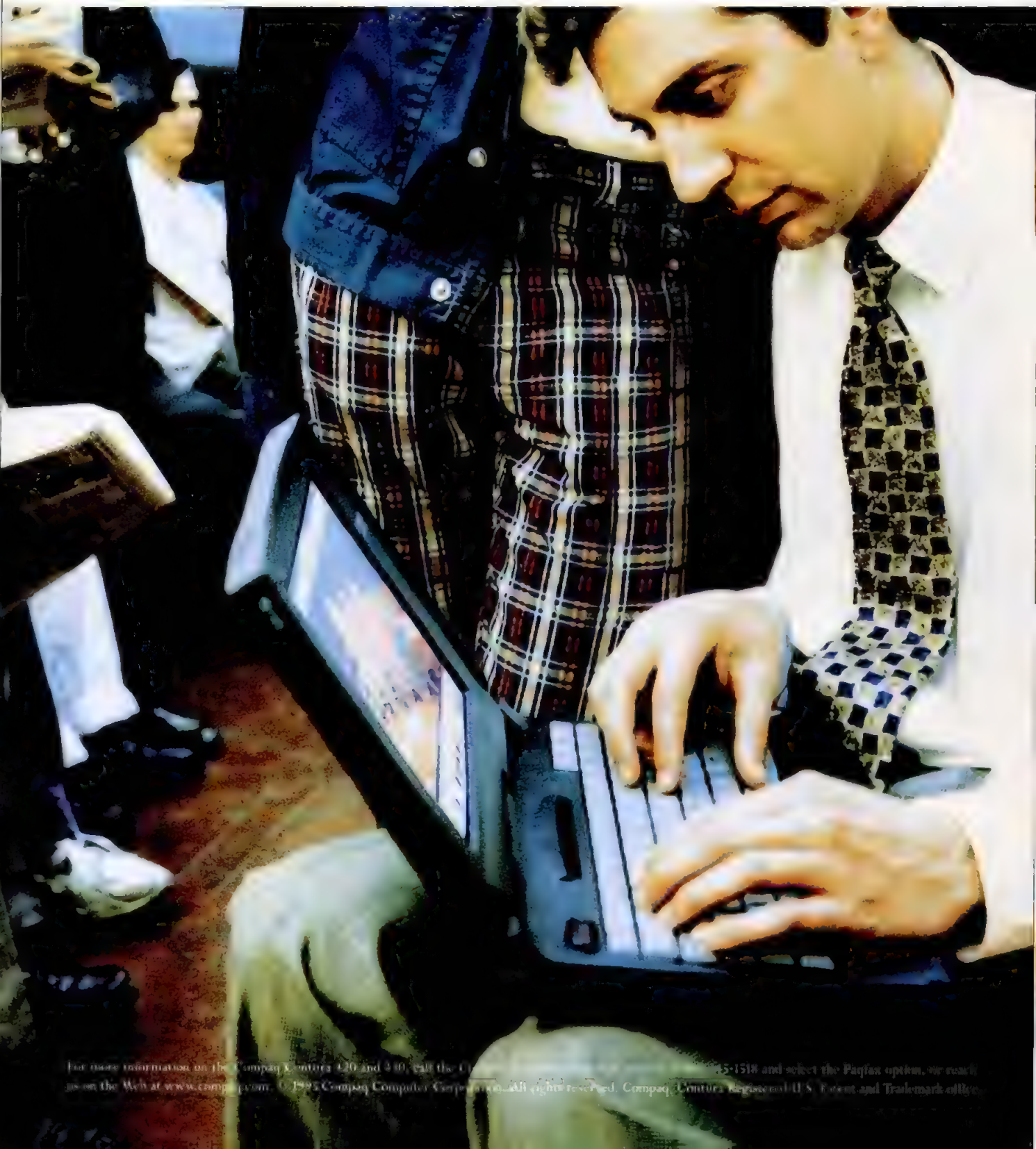

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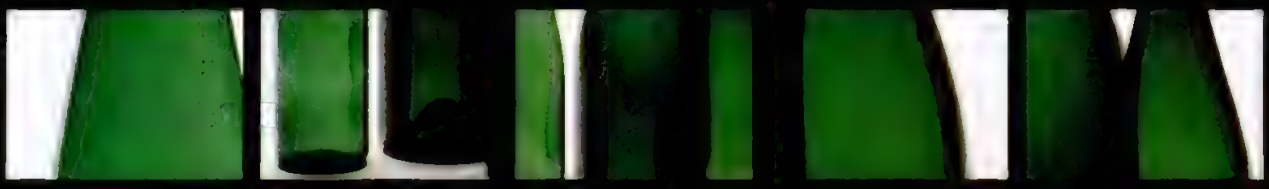
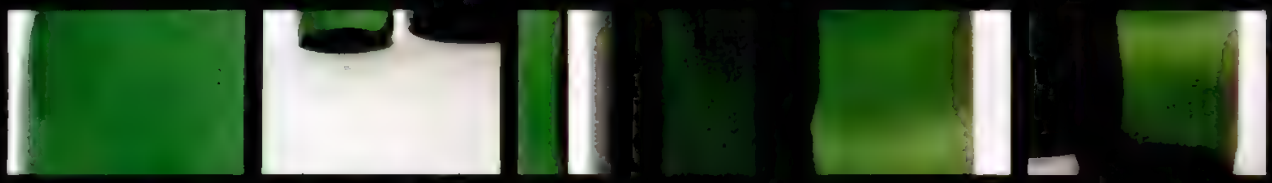


HQ's database has 40,000 bottles.



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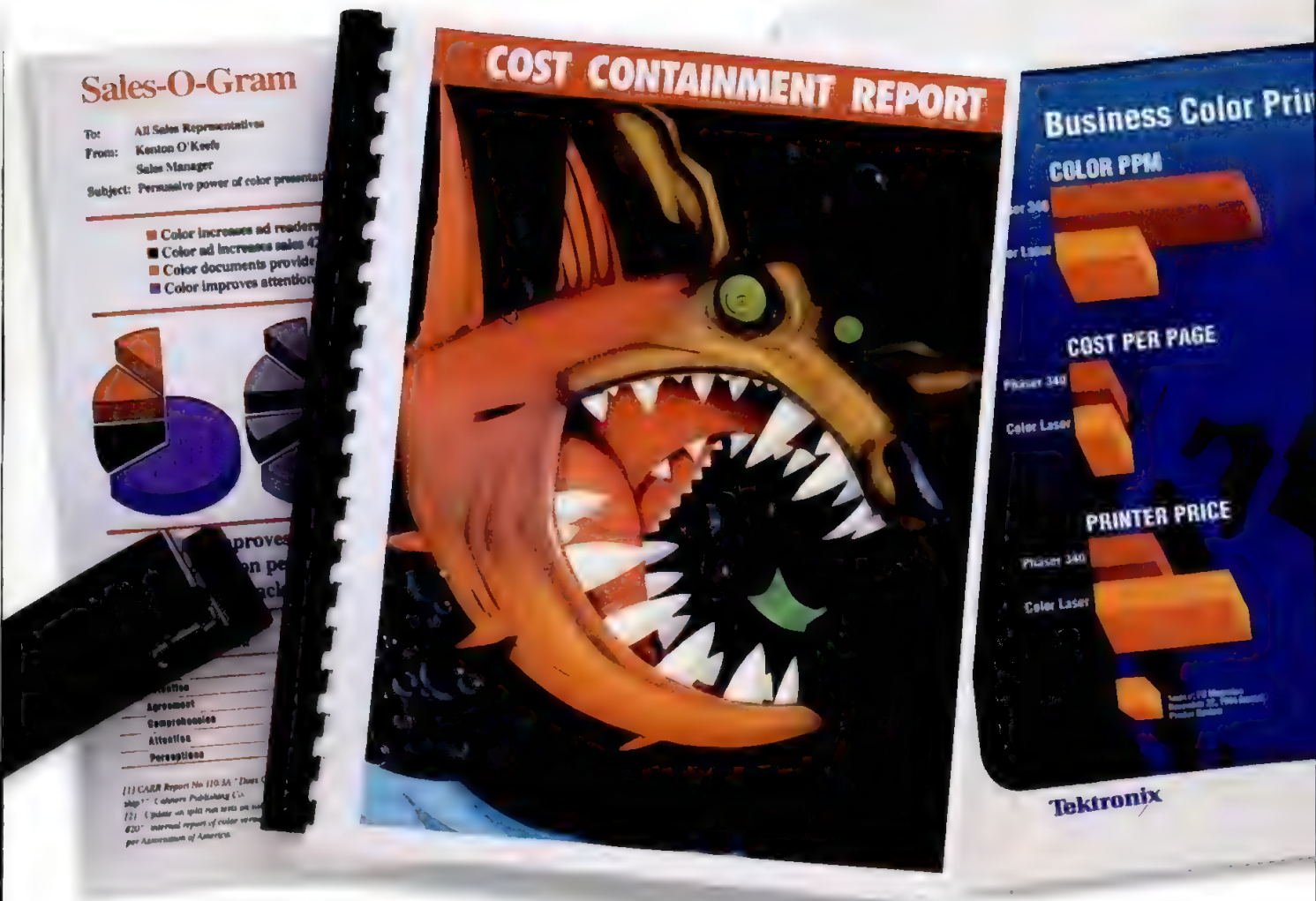

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Michael J. Miller

Windows 95 Brain Teasers

In my last column, "The Windows 95 FAQ File" (August 1995), I gave you my best answers to some of your most frequently asked questions about Microsoft's new OS. Did I answer all your questions? Probably not. After all, the pending arrival of Windows 95 has spawned all sorts of questions that no one really knows the answers to. Here are a few of those questions along with my personal take on the situation.

Will more phone calls be made on Labor Day than on Mother's Day? Microsoft has set August 24 as the day you'll be able to get the final Windows 95 upgrade, and while some of you will certainly stand in line to get the upgrade, I suspect that most of you will wait until the Labor Day weekend to perform the actual upgrade. We've been through the upgrade process before; it's always better to have a three-day weekend.

How many people will call tech support that weekend or the following Tuesday because some device or program isn't working right or just because they want a little hand-holding? Who knows? No matter what Microsoft says, we all know the installation process won't be painless on everyone's machine. There are just too many different combinations of hardware and software out there. Microsoft says it is preparing for the blitz on its technical support staff. I wonder if the telephone companies are ready.

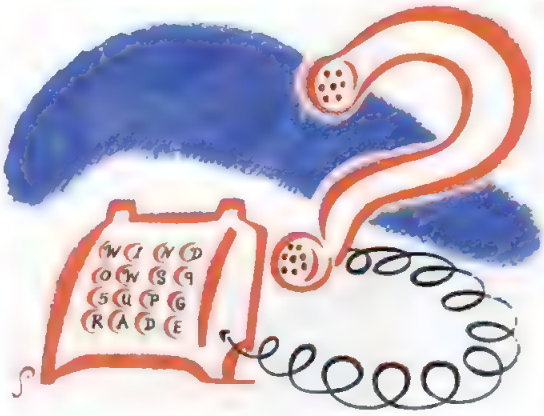
Will the new operating systems change the way people buy machines? When the dust is settled, we'll find out that regardless of the operating system—OS/2, Windows 95, or Windows NT—most users will be better off with more memory and a slightly slower CPU than with a faster CPU and not as much memory.

Although a machine with a 75-MHz Pentium and 16MB of RAM costs roughly the same as a 90-MHz machine with 8MB, people have gotten so conditioned to buying by processor speed that my guess is that most buyers will opt for the latter machine. They'll be sorry, because while their processor may be 25 percent faster, even the best hard disk is far, far slower than RAM.

Is Windows 95 just a temporary stop on the way to Windows NT? In order to get the Window 95 logo, most products—with the exception of some utilities—need to be able to run on Windows NT as well. So if Windows 95 is successful, suddenly there will be plenty of native Windows NT applications available.

Given that it now looks as if Intel's P6 design is really penalized by 16-bit code (including the 16-bit code in Windows 95, apparently), if the P6 and its brethren become significant players a couple of years from now, then the performance differences alone may be enough to make people want Windows NT. This may be true even if they don't need the extra security and protection features of the OS. The biggest drawback of Windows NT—its less-than-stellar DOS compatibility—may become less important over time.

So will people move to Windows NT instead of Windows 95, and if not, why not? In the first few months, DOS compatibility and the ability to run with less memory will undoubtedly make Windows 95 far more popular than Windows NT. I also think that OS/2 will be somewhere in the middle, and that the installed base of Windows 3.1 will be larger than the combined installed base of all three for another year to come.



Will you find yourself calling Microsoft's technical support this coming Labor Day?

Will corporate America choose Windows 95, Windows NT, or OS/2? That's the question even Microsoft can't answer. IS Managers routinely prefer to slow the rate of change, and moving to a new OS, even one that is more stable, is a frightening prospect. These folks tend to understand the protection and security arguments in favor of Windows NT or OS/2, but they have lots of Windows 3.1 machines that they dread upgrading. By and large, these folks don't

Illustration by Steven Salerno

care about DOS-device compatibility, so you'd think that when Windows NT gets a modern user interface (now expected sometimeearly next year), it would be the logical choice. But the cost of new machines and upgrading the RAM on existing machines, plus the time it takes to upgrade and then support the upgrade for each user, scares them silly.

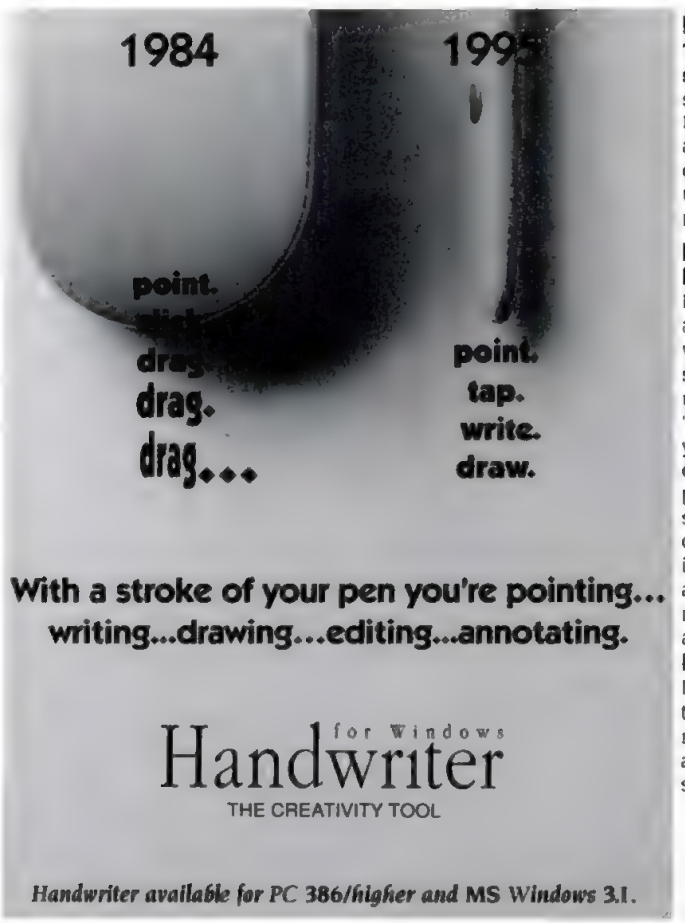
Is anyone ready for new security problems? With peer services now a standard part of Windows 95 and OS/2 Warp Connect, it becomes really easy for users to share their files and disks. Remote access features are a part of all of these operating systems. Even Internet and TCP/IP connectivity is getting easier. These are good things. Yet they also make it easier for people to make their systems more open to the public accidentally and thus more vulnerable to break-ins. All of the OSs have enough features to keep them relatively secure, but will customers understand and use them appropriately? Given the relatively small number of individual users who use comparatively simple measures such as virus checkers and regular backups, this task will often fall on network managers.

Will OS/2 gain or lose in the Windows 95 hoopla? IBM wishes it knew the answer to this one. OS/2 has gained a bit of ground in the past year, as a significant number of users decided they wanted a multitasking, multithreaded, 32-bit OS. OS/2 delivered while Windows 95 was hyped but delayed. In the coming months, IBM's challenge is to take advantage of the push behind Windows 95. After all, the biggest resistance to OS/2 or Windows NT has been simply that staying with your existing OS is always much easier. But it seems as if a lot of people are going to be making a decision to change operating systems anyway, and switching to OS/2 isn't all that much harder than switching to Windows 95.

If IBM can make a strong case that OS/2 is more stable and more mature and has enough third-party support, it could potentially make OS/2 a stronger player. On the other hand, it was easier for IBM to talk about the benefits of multitasking versus single-tasking than it will be to describe the architectural differences between OS/2 and Windows 95.

Will Windows 95 make Microsoft even stronger? This is the *really* scary question. The new operating system includes a lot of features that were once the province of third parties, including networking features, an e-mail client, fax capabilities, and the controversial client for Microsoft Network, which has already attracted the attention of the Justice Department. Other parts of the business still remain highly competitive: networking, on-line services, and consumer titles, for example. Microsoft is also far from dominant in graphics (think about the Adobe/Aldus/Frame combination) or utilities (consider the recently announced Symantec/Delrina merger).

We still need strong competitors in basic business applications software. Yet Microsoft will of course have the first full office suite out for Windows 95, and many of the developers who are bringing in new products say they want not only the Windows 95 logo but the Microsoft Office–compatible logo as well. Novell still seems firmly committed to Perfect Office, but even before the Lotus acquisition is completed, IBM seems to be wavering in its support for Lotus SmartSuite—in part because it is working on Star Office, a suite of products being brought over to the U.S. from Germany. □



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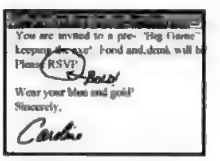

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PC Compatibility	1280x1024@60Hz	1280x1024@60Hz	1280x1024@60Hz
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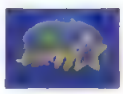

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SAMSUNG

CIRCLE 046 ON READER SERVICE CARD

Bill Machrone

The Business-Card Standard

Call it serendipity. In recent weeks, I've received mail from several readers, all on the same topic: the need for business cards to become modern communications devices. Business cards do pretty well now, conveying your name, your employer, your position, and the basic information needed to contact you. But my correspondents are advocating that the computer industry set the standards, so that business cards can do much more.

Business cards have been around for more than a hundred years. Time-honored though the business card may be, it falls short of today's informational needs. First, the sheer amount of information on the card has nearly tripled, with more complex addresses and the addition of fax numbers and e-mail addresses. Second, the proliferation of trade shows, conventions, conferences, and business meetings means that more cards are exchanged than ever before. Third, traditional filing techniques are inadequate for handling the volume and are incapable of interfacing with electronic communication systems.

Thus we come back from our trade shows with stacks of cards and the best intentions. This time, we're really going to get organized. This time, we'll key them into Sidekick, Info Select, or whatever. Or we'll get one of those new business card scanners. We'll be so organized that our coworkers and business associates will be awestruck. Yeah, sure.

Business card scanners and software have come a long way, but design is the enemy of scanning. Once upon a time, all business cards looked pretty much alike, printed on white stock with black Copperplate Gothic type. Somewhere along the way, somebody added a company logo. Then a color. Then colored card stock. Today, anything goes. By the time the software is done despeckling, deskewing, and rotating, it's a wonder that there's anything left for character recognition.

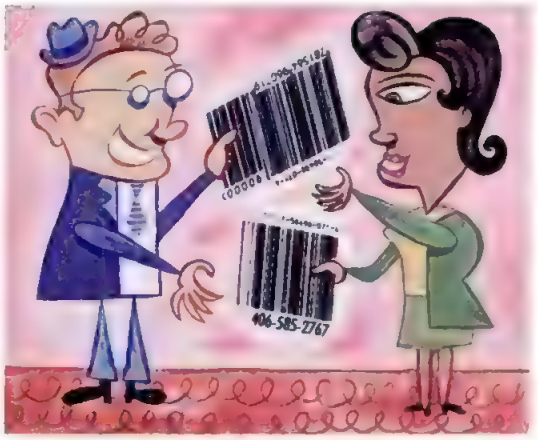
Some of my correspondents want a magnetic stripe on the business card, pretty much like the one on your credit cards. Others want a bar code. Each has its benefits. Ultradense bar codes such as Symbol Technologies' new PDF417, and even the old Cauzin SoftStrip format, can be printed by conventional techniques. Magnetic stripes are inexpensive enough to be used in fare cards printed by the millions for use in mass transit systems. Assuming that you don't use the back of your card for an alternative language, you've got several square inches back there, plenty of room for data. Since the installed base of mag stripe and bar code readers in individual users' hands is essentially zero, it doesn't matter which technology wins, as long as it's just one of them.

What will we use it for? The database stuff is the easy and obvious part. Since the computer industry and IS departments are likely to be the earliest adopters, it would be a simple matter to standardize on a format that the reader spits out for easy importation into just about anything. If the software and I/O devices are cheap enough, the rest of the world will come along—and benefit.

Authentication is a potentially huge application. In some South American countries, fraudulent representation is common. Crooks collect business cards from legitimate businesspeople and then misrepresent themselves to perpetrate a variety of scams. As a result, businesspeople commonly tear a corner of their card as they hand it to you. You don't trust a card that wasn't torn in front of you.

A more elegant solution lies in a new Kodak technology that can encode your likeness in as little as 500 bytes, readable by your PDA, notebook, or desktop machines. You could also include a machine-readable version of your public encryption key, making it easy for people to send you secure communications.

Now if only the standard were retroactive. . . . □



Are your business cards ready for a technology infusion?

Illustration by Carolyn Fisher

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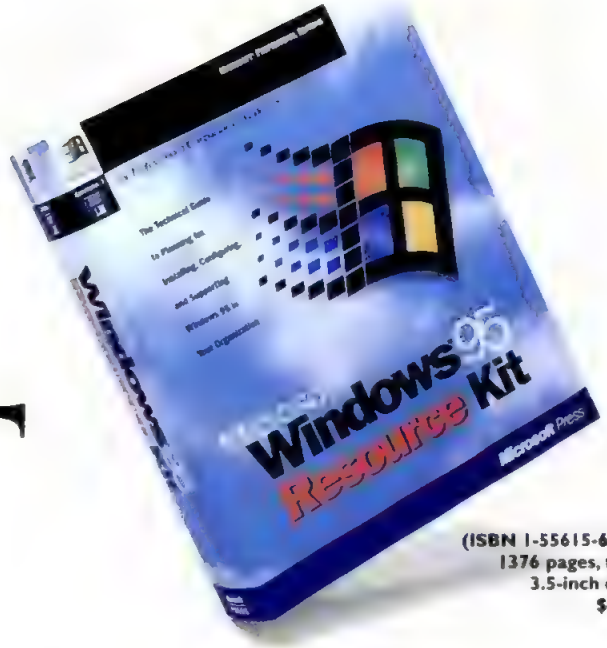

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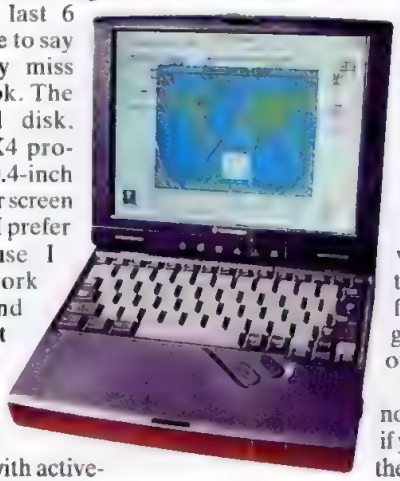
Second Looks

LIVING WITH THE PRODUCTS WE REVIEW

Give Me Liberty

In the May 16 issue of *PC Magazine,* I referred to Gateway 2000's Liberty subnotebook as the successor to the late HandBook 486. After living with a Liberty for the last 6 months, I have to say that I hardly miss the HandBook. The 540MB hard disk, 100-MHz DX4 processor, and 10.4-inch dual-scan color screen are all great. (I prefer DSTN because I do so much work on trains and planes. I hate it when people read over my shoulder, which they can do easily with active-matrix color TFT displays.)



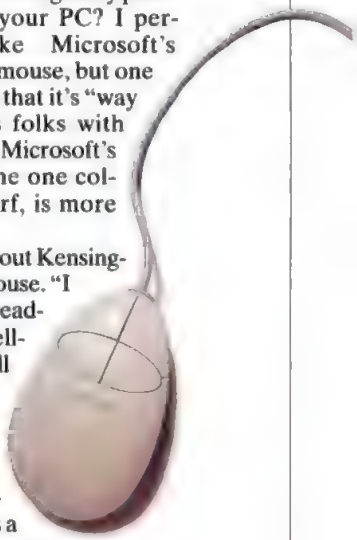
Some Libertys, including mine, have had lockup problems while running on battery. Gateway responded well to the problem and came up with a new BIOS, which can be found on the company's BBS and on CompuServe support forums.

Battery life, however, could be better, and Gateway knows it. Gateway has just switched from nickel cadmium to lithium ion batteries, which give you more time and a few ounces less weight. The Liberty's keyboard is very comfortable to use, and its far-forward location gives you a generous palm rest.

Subnotebooks are not for everyone, but if you can live without the weight of a built-in floppy disk drive, stereo speakers, microphone, and CD-ROM drive, you'll find that the Liberty is a lean, mean, computin' machine.

Mighty Mouse

Who says you have to settle for the mouse originally packaged with your PC? I personally like Microsoft's ergonomic mouse, but one reader points out that it's "way too large for us folks with smaller hands.... Microsoft's Home Mouse, the one colored like a Smurf, is more comfortable."



Others rave about Kensington's Thinking Mouse. "I love it," says one reader. "It has four well-located buttons, all programmable to whatever you want. I made one button a one-touch double-click, and it is a *huge* time-saver. Just think how often you use double-click and how often it doesn't register on a regular mouse no matter how you tweak the 'sensitivity.'"

Wishing Santa Had Gotten Me a Pentium PC

Computer manufacturers really turned up the heat last winter, with bargain prices on everything from 486SX machines through DX2/66 boxes to 90-MHz Pentiums. In our June 27 issue, I asked our readers to tell me about their Christmas machines. According to those who responded, the typical "1994 Christmas machine" was a DX2/66 or one of the slower Pentiums. Most had a sound card, a CD-ROM drive, a multiscanning monitor, and a decent video board. Some had fax modems and fancy software for household management and even for answering the phone.

Reader mail expressed a lot of satisfaction with these machines, although some who bought 486 machines wished they had sprung for Pentiums. Virtually everyone who had started with 4MB has upgraded to 8MB or 16MB. Off-brand sound cards have been a problem for a number of readers who complained about the cards' less-than-perfect Sound Blaster compatibility.

Some readers who bought 14-inch monitors exulted at the pre-Christmas drop in prices of 17-inch monitors. "Forget the 1,024-by-768 rating on my monitor," says one. "You can't see anything. I'm trading up to a 17-incher."

Fancy telecommunications options may have sounded great in the showroom, but few readers are using them. Fax modems are seldom used for faxes, nobody is using voice-control software, and virtually no one is leaving their machine on so it can answer the phone.

The buying season attracted lots of novices, too, who found out the hard way about tech support. IBM was a winner, as was Gateway, but with sluggish response times. ZEOS and AST were losers.

How to contact Second Looks: On ZiffNet type GO ZNT:EDITOR, and choose Views: Machrone. Contact Machrone directly via MCI Mail at Wmachrone or CompuServe at 72241,15. You can also find us on the World-Wide Web at *http://www.ziff.com/~pcmag.*

LOOKING AHEAD

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Photographs by Thom O'Connor/ Illustration by Scott Baldwin

A picture is worth
But for some reason, Hew

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CIRCLE 038 ON READER SERVICE CARD

John C. Dvorak

The Looming Cable Modem Fiasco

The noisiest buzz in the industry lately has been over the emerging use of cable TV systems to provide fast network data transmissions using a device called a cable modem. But the likelihood of this technology succeeding is zilch. It's one of those interesting-sounding ideas that will attract what venture capitalists call dumb money. Unfortunately, it's a big distraction in a market that should be concentrating on ISDN and broadband.

HP, U.S. Robotics, ZDS, and others have been toying with the idea for a few years, and Motorola Multimedia Group's recently announced CyberSurfer 10-Mbps cable modem has completely muddied the waters. There's also LANCity's announced $595 model. Until recently, these things cost a ridiculous $5,000.

Cable modems are, of course, targeted at Net surfers. According to the press announcement, the CyberSurfer will be the fastest, receiving data at 10 Mbps and sending it at 768 Kbps. Exactly how the modem will work on the largely one-way cable systems in the U.S. is a mystery. And since there's no governing standards organization for cable modems, these devices won't be able to talk to modems made by anyone else. But hey, they sure are fast.

Even so, users with access to a T1 phone connection will soon discover that the fastest provider can send data at only around 56 Kbps—slower than a single B-channel over ISDN. This isn't likely to change as providers try to serve as many users as possible, rather than pump 128 Kbps or more to a few people. So the ideal connection for Net surfing is a single B-channel on an ISDN line.

So even if you had a 10-Mbps cable connection, it would be useless except for point-to-point transfer at Motorola's upstream speed of 768 Kbps. And that assumes upstream capability, which the cable companies will have available in only a few test areas. If users don't flock to this technology in those areas, the cable companies will drop the idea like a hot potato.

We have to remember that, collectively, the cable TV folks are as dumb as fireplugs. There is no incentive to be otherwise. They have monopolies and do little more than string wire and milk the cash cow. Why would they want to get mixed up in something that requires real work? If you doubt this, visit your local cable company and ask "When will you have cable modem capability?" Just see what they say. My guess: "Huh? What's a modem?"

Then there is the issue of security. The cable TV system is a broadcast medium, not a secure network. All transmissions over cable are highly susceptible to hacking. Much more so than anything else except cellular phones. HP is one company that harps on the security issues regarding cable modems.

So why spin our wheels over a dead-end technology when ISDN is here now? Is speed really the issue?

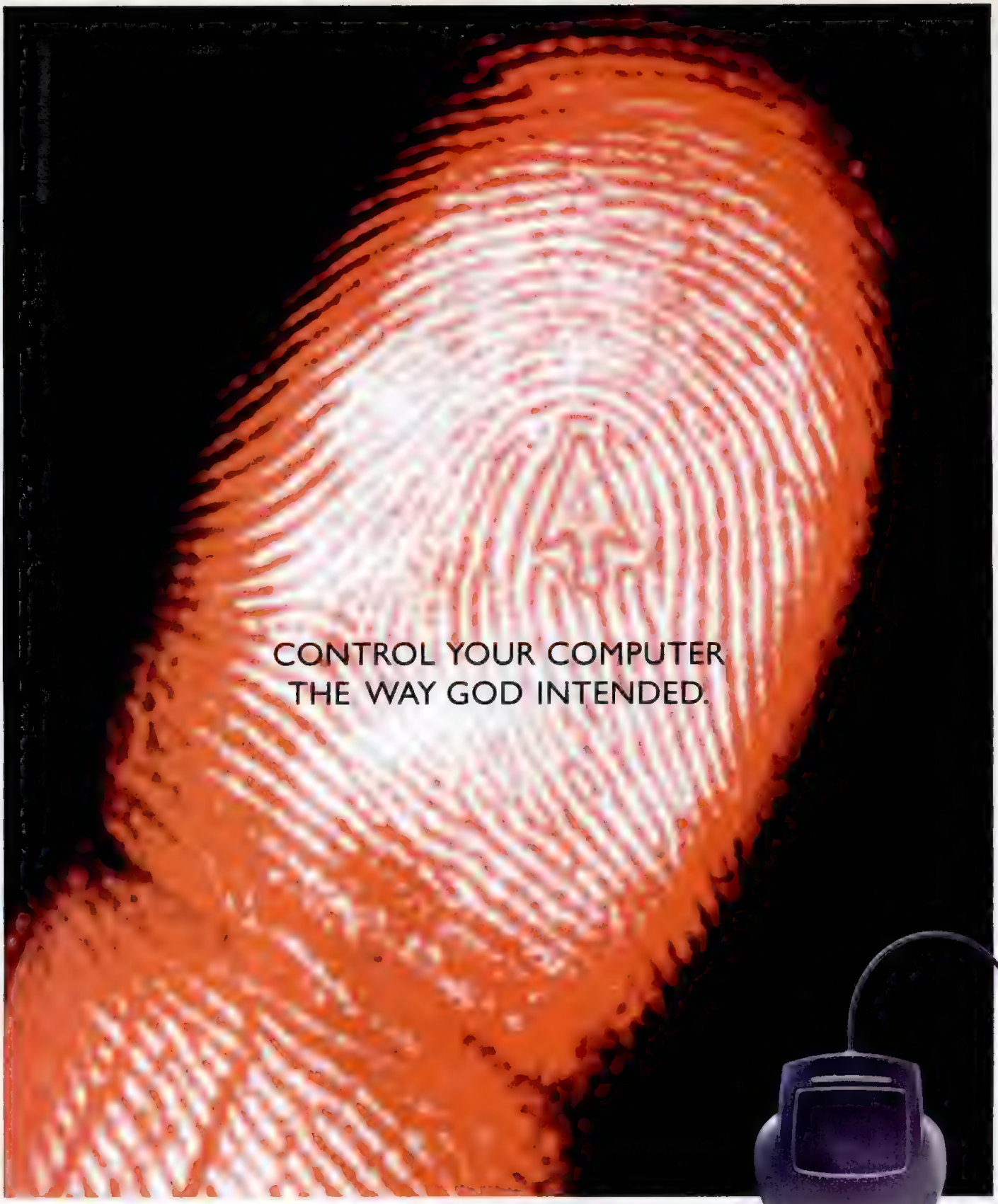
There may be another element at play. When you consider digital phone networks and the equipment that is needed to hook up ISDN, you see an interesting phenomenon. The modem companies aren't in the game. Networking companies run the show: Ascend, Cisco, and Combinet. Modem companies like Hayes—and recently Zyxel—miss the mark with ISDN. Others have ignored it completely.

Why do we spin our wheels over a dead-end technology when ISDN is here now? Is speed really the issue?

In a digital world, you won't need to MOdulate/DEModulate (the root meaning of *modem*). Many users just can't make the transition to a future where the modem is moot. For these sentimentalists, the cable modem is the last gasp. But there are no cable modem standards whatsoever, and very little cable modem promotion within the brain-dead cable TV industry. While this fiasco unfolds, we hear cheering from people who should know better and examine the simple illogic of the whole thing.

Hey, but it sure is fast.

Illustration by James Steinberg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John C. Dvorak

Inside Track

PC Expo in New York is the enigma of computer shows. Seen as a regional show by many, it nontheless attracts ever-larger crowds, and it seems to be **getting more popular** every year.

It also manages to attract **important** press announcements, not the least of which was IBM's announcement of its Power Series of PowerPC machines that run Windows NT 3.51. I'm still trying to find my invitation for this announcement, as I heard about it while at Apple's same-day press event for its newest PowerMacs that use the same CPUs. A few reporters at the Mac event were aware of the IBM announcement, but none of them knew where or when the IBM function was. In fact, it was just before the Mac event, someplace in New York.

This whole IBM PowerPC scene is the biggest flop I've seen in 20 years. It's horrible, since the PowerPC may have represented a new standard platform for high-end users.

I suppose if IBM played a **hot hand,** people would be scrambling to find out where and when such events were, just as everyone is scrambling to get invited to the gala for Windows 95. Unfortunately, IBM, instead of making darn sure everyone was at the PowerPC announcement by promoting the event, assumed people would **magically come.** I'm told the affair was a **dud.** This whole IBM PowerPC scene is **the biggest flop** I've seen in my 20 years working with microcomputers. Too little too late.

IBM was outflanked and outsmarted by Microsoft and Intel at every turn. Nobody cared about what should have been a **monumental** roll-out. It's horrible, since the PowerPC may have represented a new standard platform for high-end users. Instead, we are going into the twenty-first century riding a rocking horse called Windows 95.

So while roaming the streets of Manhattan, I roll into the CompUSA store on Fifth Avenue, where I'm immediately greeted by a pile of boxes containing Microsoft Office. They **paid dearly** for the location, I'm thinking to myself. Right next to it is Novell's WordPerfect. They also paid dearly for the location. Too bad they didn't pay dearly for the box design. It's perhaps **the worst box** ever done for a mainstream product. But then again, maybe I'm picky. It just looks dull. Its point of interest is a **photograph of a fountain pen nib.** You'd expect to find a fountain pen or a bunch of nibs inside this box. What is the message here? Place it in a stationery store and see what people think. "Oh, is that a box of nibs? I need one for my old pen."

Meanwhile, Ray Noorda is more or less out of Novell, starting a company called Caldera to market (get this) Linux, the inexpensive Unix variant. Let's see, he had the Real McCoy Unix at Novell and couldn't market it as a stand alone OS, but this he can sell? **How does this work?** Even more curious is the rumor that Novell will release a **Linux optimized version of WordPerfect.** It is important to note that Novell has stopped developing WordPerfect for the 4 to 5 million OS/2 users. Instead, they will do a Linux version. It will probably use the same fountain pen box, too. Sheesh, this is what happens when you **isolate yourself** in the Utah desert. They must be laughing extra hard in Redmond.

So back to the CompUSA store. I follow around a salesperson to listen in on the conversations about what people care about and what they're buying. Here are a couple of the more interesting snippets. A guy is looking for a laptop and asks, "What about Compaq?" The sales guy, seemingly pushing Toshiba, says, "You don't want a Compaq, they're not competitive." I almost laugh out loud. I'll bet the marketing folks at Compaq will love this anecdote when it gets passed around the office. The other good one is over in the modem section where there is a special on 14.4-Kbps modems. The customer asks, "What about this 28.8 modem?" The sales guy says, "That's only good if you have real high phone bills and are calling another V.34 modem. The modem you want is this 14-dot-4 modem; it's the one everyone has standardized on and that's important." Oh brother.

Genuinely Interesting Software Dept.: Spend $79.95 and get the Symsoft Digital Funhouse, an image manipulation program unlike any other on the market. Think of it as a Funhouse mirror for the PC. It also features utilities that facilitate printing 100 images on a page, photo-label printing, image browsing, and sticker printing. Easy to use—and always fun—it's a perfect accompaniment for new products out there, such as those digital cameras and frame grabbers. What's **ultra cool,** though, is a subsystem within the program that exports an image for fax output, **which is nothing less than phenomenal.** The received fax actually looks like a high-resolution photograde laser print. I've never seen anything as good. If you need to fax a photo, you need this product. Contact Symsoft at 702-832-4300 or fax them at 702-832-4310 for more information.

Inside Track reader Bob De Long writes, "Have you gone to a department store and seen that odd-looking Timex watch with the Windows logo on the band? Did you also notice that on the other side of the band there are binary numbers? And that with enough time and patience (and an ASCII chart), you can decipher a hidden message? Here's what it says: 'Listen To The Light.'"

Who says my readers have too much free time? □

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Jim Seymour

Tucking a Home PC Under Your Arm

My family and I just returned from a blissful month beside a lake in northern Canada. Though we were pursuing some very traditional, analog values on the vacation, we took along one of the new multimedia notebooks. Boy, were we glad we did.

My wife and I checked our e-mail and got some writing done in a marvelously serene and often very solitary setting. And the machine's CD-ROM drive, a stack of CD-ROMs, and headphones for preserving the lakeside serenity meant that Arthur (of Teacher Trouble fame), some Knowledge Adventure and Dorling-Kindersley titles, and a handful of favorite audio CDs we brought along gave our whole family a lot of fun, too.

Our son spent most of his time on the beach—bringing a pasty-faced kid home from a month at the beach would have been a terrible indictment of his parents!—but to our immense relief he burned off his surplus prebedtime energy at the PC. And we had our Hotline telephone and address list at our fingertips, which proved invaluable.

That trip convinced me that multimedia notebooks make a lot of sense as home PCs. If you'll be hauling the box off to work every morning, then by definition it's not a "home PC." But for regular use at home—and for occasional road trips—they're the next wave of family PCs.

It's no news that notebooks have turned the PC market upside down. For many PC makers, notebooks are now the fastest-growing part of their business. And businesspeople are increasingly using notebooks as their *only* PCs, not as away-from-the-office extensions to desktop machines.

Now notebook PCs are about to crowd into the home-PC market as well. I think a notebook will be on many *PC Magazine* readers' short lists next time they go shopping. If you see a home PC only as a workday extender or as a machine that lets you telecommute, this must sound strange. Kids? Games? On the Toshiba?

The broader definition of home PCs, however, is the definition that's driven their explosive growth over the past year. These are machines for the whole family, with as much attention paid to games, education, entertainment, and other multimedia computing as to spreadsheets and e-mail. By that standard, notebooks have been pretty poor choices as home PCs.

Small screens with poor color and limited video capability, mediocre sound or none at all, no CD-ROM drives: These and other limitations of most notebooks make them look fairly shabby up against the snappy display, speedy video, boom-box sound, and mega–CD-ROM bundle of the latest $1,799 wonder from Packard-Bell.

That's about to change.

Beginning this month and continuing through the Christmas season, we're going to see dazzling new multimedia notebooks. In a portable computer market divided ever more sharply between small/light and big/powerful, the full-size 7-pound multimedia notebook is turning into a monster.

The most impressive of the new machines is Gateway's Solo, which should be announced about the time you're reading this. The definitive 7-pound monster—oops, "multimedia notebook"—for now, it drips with speed and capability. A travelling presenter's dream, it's all the PC 95 percent of business users need.

It has an internal CD-ROM drive you can swap for a floppy disk drive or extra battery, good stereo sound, and a 10.4-inch active-matrix 800-by-600 display with enough speed to make video clips look like. . .well, video. Built around a 90-MHz Pentium for now, and soon upgradable to an even faster Pentium chip, thanks to a CPU-daughterboard design, this is *the* hot box.

And surprise! It's a heck of a home PC, too. The display is big enough and good enough that kids and adults alike will enjoy using it.

Our trip to the lake convinced me that multimedia notebooks make a lot of sense as home PCs.

Illustration by Philippe Lardy

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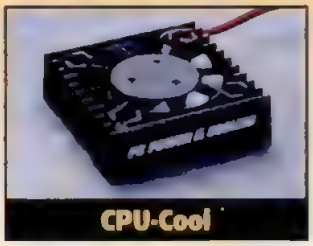
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(Also helpful, of course, is the fact that most CD-ROM titles use only 640-by-480.) And you can hang a joystick off its serial port.

Gateway may be leading the pack right now, but it will soon have serious competition from the usual name-brand competitors. I've seen impressive new multimedia notebooks all summer long in demos; as those machines are announced and delivered, we're going to see a furious contest for market leadership. You'll pay a hefty premium over the cost of a similar desktop machine, of course—maybe $3,500 to $4,000 versus $2,500—so there had better be compelling reasons to buy the notebook.

There are.

SIZABLE CONCERN

The most obvious advantage is size. Not only do notebooks demand less space in the perpetually crowded home-PC nook, they can also be moved or folded up and stashed when you need to recover that space for other purposes. With a small, inexpensive port replicator to handle quick-on/quick-off connections for power, speakers, and printer, folding up the machine becomes a realistic alternative to dedicating a sizable desktop area to the family computer.

Second, consider noise. When your kids are blasting away in Dark Forces, any computer will be irritating to others—though, as we were reminded on our vacation, earmuff-style headphones can civilize even the toughest Star Warrior.

Only a fanless notebook is truly quiet, no matter how you're using it. I find the noise of desktop computers' fans grating, and I'm surprised how often the topic comes up in reader mail and ZiffNet on-line forums.

Third, remember that battery-powered notebook PCs have built-in UPSs. When power goes down, you don't. I wrote through glorious late-night thunderstorms without a worry. When things looked *really* nasty outside and I worried about power surges, I unplugged the AC cord and continued working. The batteries lasted far longer than I did, though that was due as much to beach and sun as to lithium-ion magic.

Finally, there's portability. That's self-evident—these are, after all, portable computers—but portability's value in a family machine may not be quite so obvious. As we found out on our trip, though, being able to bring a home computer with you can be a great advantage. □

Bill Howard

Are PCs Worth the Wait?

Conventional wisdom, not to mention the wisdom gained from personal experience, tells you that whenever you buy a PC, newer technology comes along swiftly and makes you regret that you hadn't waited a few more months. Let's consider what would happen if you were to wait six months, until early 1996, to order your next PC. What will be the technology shifts that'll make you wish you waited?

By the fourth quarter, we'll see the first systems based on Intel's P6 processor. The P6 represents a quantum leap in transistor count (5.5 million, compared with the Pentium's 3.3 million), but its performance gain remains a question. Users running Windows 95 might see only fractional gains, and Windows 3.*x* might even run slower. We expect the CPU cost will be closer to $1,500 than the $750 to $1,000 you pay for a high-end Pentium chip now, but the P6 cost includes an integrated 256K or 512K cache. Only with Windows NT and 32-bit applications will you see a noticeable performance gain, of perhaps 25 to 50 percent.

So if you're a power user, score one for waiting. Otherwise, the next six months will offer more of the same, only bigger, faster, and cheaper. We'll see Pentium-class CPUs from Cyrix and later AMD, but the point of these chips is that you're not supposed to notice any difference. And the chance of systems based on RISC processors encroaching on the *x*86 mainstream is nil.

Hard disk capacity will creep up and prices will creep down, but whether you get a 1.2GB disk now or 1.6GB at year's end for the same price isn't crucial.

Sextuple-speed (6X) CD-ROM drives are something of an improvement over quad-speed, but not the same as going from single to double to quad speed. We're on the verge of breakthrough technologies in alternative mass-storage devices such as read/write optical drives in 1996 (keep an eye on Pinnacle Micro) and $1,000 CD-ROM recorder/players in late 1995, but nothing to shift us away from traditional hard disks in the short term.

We will see further improvements in motion video. MPEG hardware for full-screen, full-motion video could revolutionize the home/edutainment part of the business, and eventually it will make inroads into business PCs. You could add MPEG via a PCI expansion card, but there aren't the cost efficiencies you'd experience from an integrated solution such as S3's new chip set, which has been adopted by Compaq and which may add about $100 to the price of a home PC. Traditional graphics adapters will get better, but the pace of progress will be linear.

Color LCD panels will hit 12 inches shortly, and that's roughly equal to a 14-inch CRT display, except in cost. If I were a monitor maker with skills only in traditional CRTs, I'd be worried about being in business in the year 2000, when we'll have 17-inch flat-panel LCDs. But that's long-term.

We're on the verge of a new I/O connector standard called universal serial bus (USB). Think of it as a mini-network encompassing your keyboard, mouse, monitor controls, joystick, printer, modem, and possibly external CD-ROM drive, all with thin cables and phone-style connectors. A year and a half from now a PC might have only USB connectors; an early-1996 PC would need the current connectors, too. That's one feature *I'd* wait for, but I think most business buyers won't care until there's a critical mass of USB printers and mice available.

The big leaps in technology are still the better part of a year away. Short-term, the changes are incremental. Unless you have to have a P6 or a new way to connect your keyboard, what you'd buy next February or March will be only marginally different from what you'd get in August or September. □

Are you waiting for the next great technology breakthrough before you buy your next PC? Don't.

Illustration by Tom Garrett

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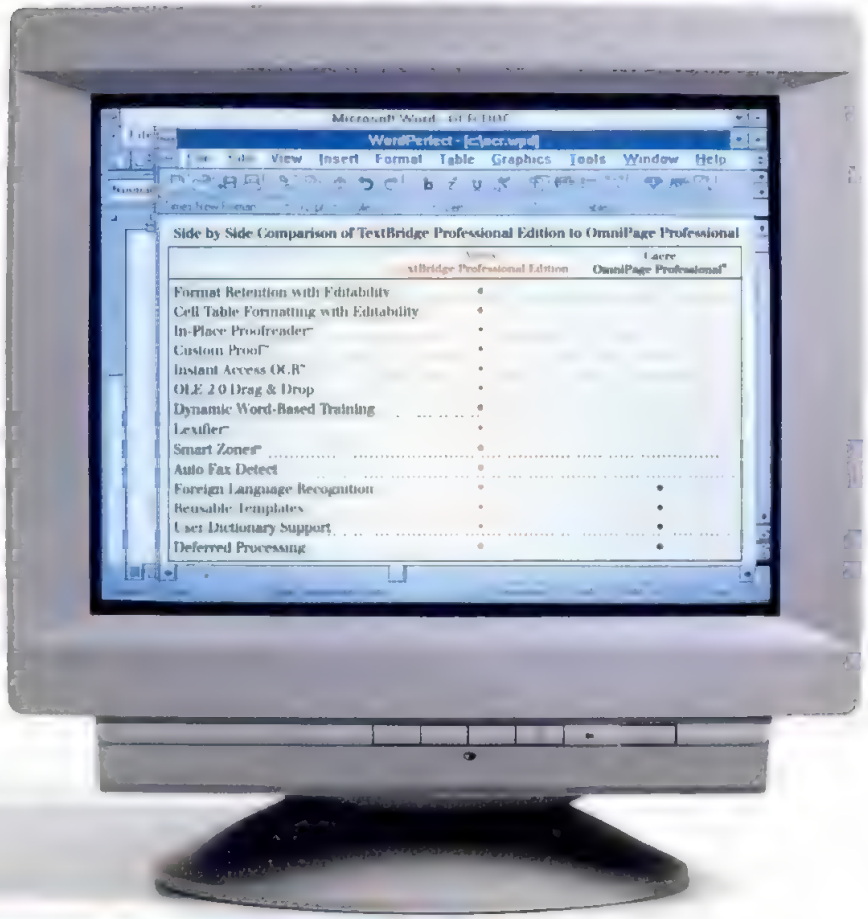

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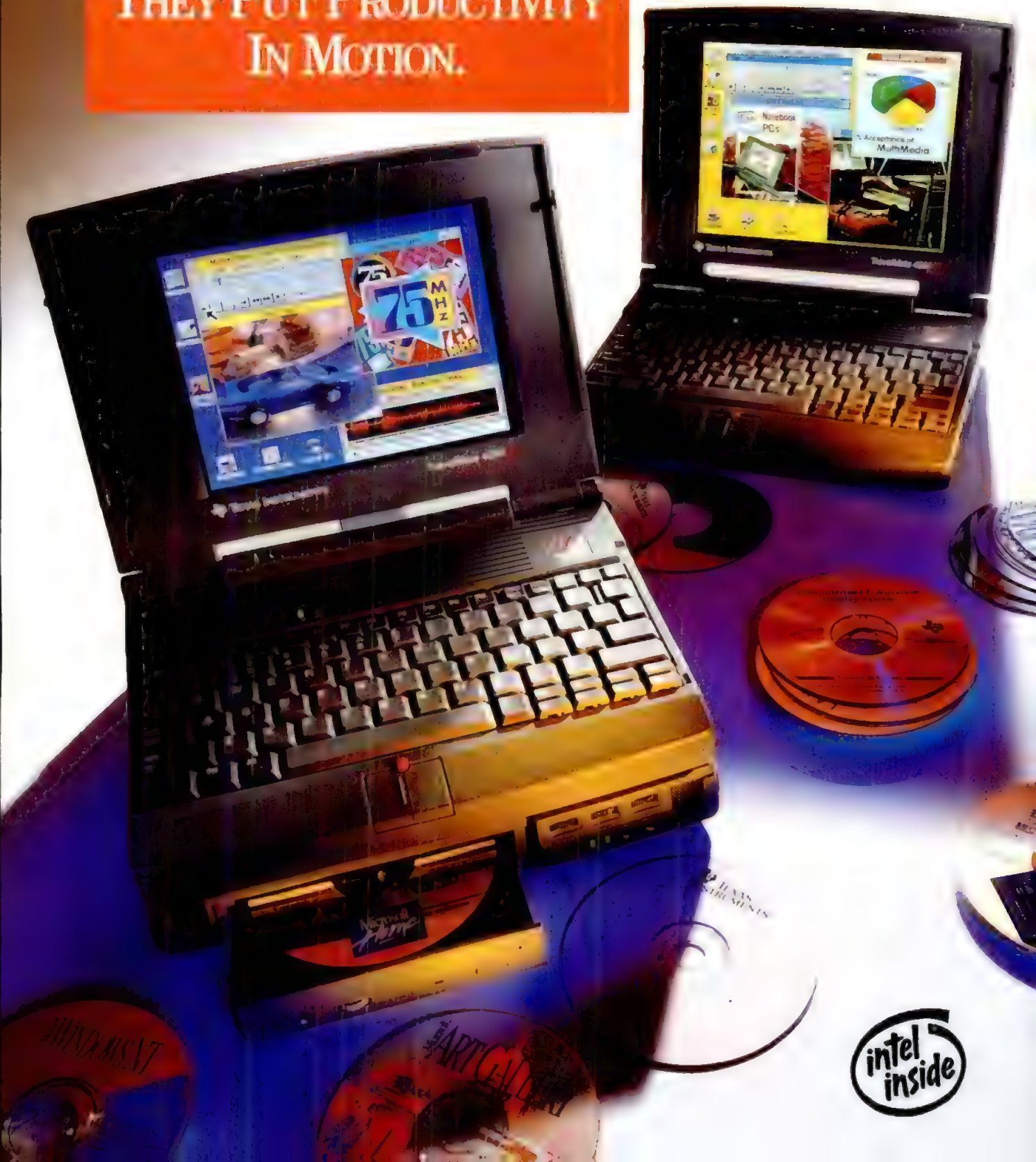

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CIRCLE 304 ON READER SERVICE CARD

P6: The Next Step?

The successor to the Pentium may not be what you expected. For top performance, you need 32-bit applications and a fully 32-bit operating system—even Windows 95 won't do.

By Sebastian Rupley and John Clyman

If you're a serious power user, talk of a new generation of *x*86 processors probably elicits an almost Pavlovian drool of excitement. And Intel's P6, the next-generation successor to the Pentium, certainly looks like a technological masterpiece in the making. But if you were expecting the P6 to double the performance of the Pentium, hold on for a disappointment. In a best-case scenario, we expect the first P6 systems will run typical business applications 40 to 60 percent faster than Pentium PCs shipping at the same time.

That may not sound bad, but it's based on a big assumption: Namely, that you are running 32-bit software on a fully 32-bit operating system such as Microsoft Windows NT or OS/2. With 32-bit applications under Microsoft Windows 95, we expect the P6 to outperform fast Pentiums by only about 20 to 30 percent. And Intel acknowledges that with 16-bit applications under Microsoft Windows 3.1, the P6 is likely to underperform the Pentium. The P6 may earn the dubious distinction of being the first *x*86 processor to run slower than its predecessors on existing code.

Given that the P6 contains nearly twice the number of transistors as the Pentium, it will be substantially more expensive to manufacture. So when the P6 is introduced this fall, Intel will be forced into a difficult positioning battle, both against the company's own existing products and against growing competition from other *x*86-processor manufacturers. Intel's strategy is therefore to market the P6 not as a direct successor to the Pentium, but as a high-end—almost workstation-class—alternative.

It's not unusual for new processors to be positioned for high-end desktops

CPU Time Line

The x86 CPU family has come a long way in 17 years: The P6 offers nearly 1,000 times the raw speed of the 8086. Here are a few dates in the PC industry's evolution.

1978 Intel 8086 16-bit registers, 16-bit data bus. Introduced: June 1978. 29,000 transistors. 4.77–10 MHz, <1 MIPS. Initial price: $360

1979 Intel 8088 8086 with an 8-bit data bus. Introduced: June 1979. 4.77–8 MHz.

1981 IBM PC introduced with the 8088 processor

1982 Intel 80286 16-bit registers, 16-bit data bus, protected-mode operation Introduced: February 1982. 134,000 transistors, 6–12 MHz, 1–2 MIPS Initial price: $360.

1984 IBM PC AT introduced with the 80286 processor

1985 Intel 80386 32-bit registers, 32-bit data bus Introduced: October 1985. 275,000 transistors, 16–33 MHz, 6–12 MIPS. Initial price: $299

1985 Microsoft Windows introduced.

Illustration by David Foster

and servers because of their initial high cost and limited availability. But this time, Intel had little alternative: The same design that is intended to accelerate the P6's performance running 32-bit code turned out to be a severe hindrance when running existing 16-bit code. (The vast bulk of applications shipping today are written in 16-bit code, although 32-bit applications are likely to become more commonplace following the shipment of Windows 95.)

The P6 does look especially promising for two markets: engineering and graphics workstations, where its relatively strong floating-point performance is a benefit, and servers.

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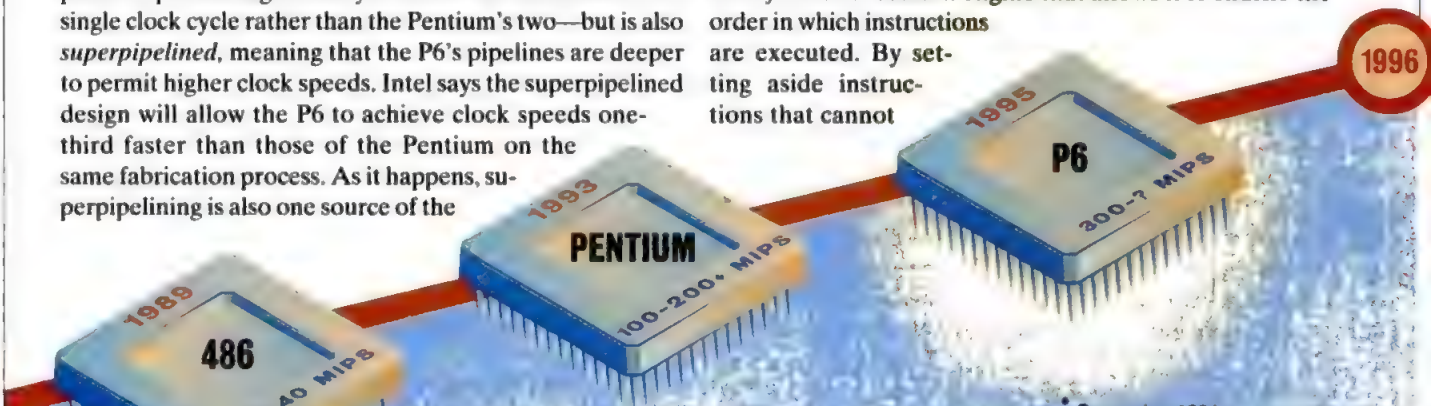
A RISC-Y HERITAGE

In its quest for high performance, the P6 raids the RISC bag of tricks. The P6 is not only aggressively superscalar—capable of processing as many as three *x*86 instructions in a single clock cycle rather than the Pentium's two—but is also *superpipelined*, meaning that the P6's pipelines are deeper to permit higher clock speeds. Intel says the superpipelined design will allow the P6 to achieve clock speeds one-third faster than those of the Pentium on the same fabrication process. As it happens, superpipelining is also one source of the P6's performance problems with 16-bit code; see the sidebar "Why the P6 Prefers NT."

The P6 will initially run at clock speeds of 133 and 150 MHz, and 200-MHz-plus versions are likely. (By contrast, Intel promises 150-MHz Pentiums later this year and expects the processor to top out at 180 to 190 MHz.) The P6 communicates with the external world at various fractions of its internal clock speed, yielding system buses that run at anywhere from 50 to 66 MHz. PCI buses will run at half that speed.

Initially, the P6 CPU will be fabricated on the same 0.6-micron BiCMOS process used to build most Pentiums. By next year, Intel will move to a 0.35-micron process (currently being used for some 120-MHz and all 133-MHz Pentiums), which will allow for higher clock speeds.

The P6 complements its superpipelined design with an *out-of-order* execution engine that allows it to shuffle the order in which instructions are executed. By setting aside instructions that cannot



1986 Compaq Deskpro 386/16 introduced.

1987 IBM PS/2 series introduced with Micro Channel architecture and OS/2 operating system.

1988 Intel 80386SX 80386 with a 16-bit data bus. Introduced: June 1988. 16–33 MHz.

1989 Intel 486DX 32-bit registers, 32-bit data bus. Integrated math coprocessor. Introduced: April 1989. 1.2 million transistors, 25–50 MHz, 20–40 MIPS. Initial price: $950.

1990 486DX/25 PCs introduced.

1991 Intel 486SX 486DX with no math coprocessor. Introduced: April 1991. 16–33 MHz.

1992 Intel 486DX2 Clock-doubled 486DX. Introduced: March 1992. 50–66 MHz.

1993 Intel Pentium 32-bit registers, 64-bit data bus. Superscalar. Introduced: March 1993. 3.2 million transistors, 60–133 MHz, 100–200+ MIPS. Initial price: $878.

1994 Intel Pentium "P54C" 3.3-volt, 90-MHz Pentium.

1994 Intel DX4 Clock-tripled 486DX with larger cache. Introduced: March 1994. 75–100 MHz.

1994–96 Pentium competitors:
- NexGen Nx586, introduced: September 1994.
- Cyrix M1 due in late 1995.
- AMD K5 due in early 1996.

1995 Intel P6 32-bit registers, 64-bit data bus. Superscalar; out-of-order execution; integrated L2 cache. Due in the second half of 1995. 5.5 million transistors (exclusive of L2 cache). Initial clock speeds: 133 and 150 MHz.

P6 Performance Data On-Line

Turn to our on-line sources to find late-breaking performance data for preproduction P6 systems. Results are available on our World-Wide Web page (*http://www.ziff.com/ -pcmag*), by anonymous ftp (*ftp.pcmag.ziff.com*), or in the Hardware Library of *PC Magazine*'s Editorial Forum (GO EDITOR) on ZiffNet/CompuServe.

be executed immediately and processing subsequent instructions that can, the P6 is able to avoid some of the conditions that would stall a processor such as the Pentium, whose pipelines operate in strict lockstep. Of course, the P6 ultimately ensures that all instructions are completed in a way that produces the correct results. (See the following story, "Inside the P6," for details.)

Internally, the P6 converts *x*86 instructions into RISC-like operations that Intel calls *micro-ops;* this helps simplify processing of the notoriously convoluted *x*86 instruction set. (AMD's forthcoming K5 processor and NexGen's Nx586 each use a similar technique.) The P6 employs *register renaming* to help enable out-of-order execution and to work around another classic *x*86 bottleneck: the limited number of architectural *registers* defined in the instruction set.

The P6 is also unique among mass-market processors in that it actually contains two chips in a single package: the CPU proper and either 256K or 512K of high-speed L2 cache memory. (See the sidebar "The P6 Bus: Optimized for Speed, Multiprocessing.") Intel refers to the P6 package as a *dual-cavity* design; other processor manufacturers sometimes refer to a similar implementation as a *multichip module.*

DESIGN IMPLICATIONS

Aside from its goal of improving performance, the P6's integrated L2 cache has enormous implications for system designs. In Pentium-class systems, the design of memory subsystems—which include the processor, L2 cache, and main memory—has become a major differentiating factor. High-end systems pair 120- or 133-MHz Pentium processors with 256K or 512K of pipelined synchronous-burst cache and EDO (extended data out) DRAM. Mainstream machines use less expensive asynchronous SRAM and standard fast-page mode DRAM. Some manufacturers may leave out L2 cache altogether to achieve

Why the P6 Prefers NT

By John Clyman and Nick Stam

Intel's positioning of the P6 processor is clear: This is a CPU for high-powered users running high-end applications, not for mainstream users. While new processors have always been aimed at power users (if for no other reason than their high cost), the case for marketing the P6 to the PC stratosphere is particularly strong. The processor's design was optimized from the start for 32-bit applications, and as a result early P6 systems will run existing 16-bit applications slower than a high-end Pentium machine.

That means that the processor won't be a benefit to the vast majority of software now available, which contains 16-bit code and is usually run atop a 16-bit operating system such as Microsoft Windows 3.1. To exploit the performance-enhancing features of the P6, you will need both a 32-bit operating system and true 32-bit applications. Today, that effectively means Microsoft Windows NT, OS/2, or Unix and only a handful of office-automation, engineering, and graphics packages.

What about Microsoft Windows 95? We expect that the P6 will run 32-bit applications under Windows 95 only 20 to 30 percent faster than a Pentium. Windows 95 is important for the P6 not because the operating system is largely written in 32-bit code, but because the new OS will spur development of a variety of 32-bit applications. Power users will want to take the 32-bit applications and pair them with Windows NT to get the most from the P6.

WHAT'S THE PROBLEM?

The P6's limited performance while running 16-bit code is not a bug but the result of a design decision Intel says it made early in the P6's design process. Looking years ahead at that time, the company anticipated that much of the PC world would have completed the transition to 32-bit operating systems and applications. But numerous factors, including the delayed delivery of Windows 95, slowed the crossover.

Intel anticipated that much of the PC world would be using 32-bit apps and OSs. So the P6 was designed to target that market.

The P6 aims to maximize its performance by employing an out-of-order execution technique that lets it shuffle instructions to keep its pipelines as busy as possible. But certain instructions cannot be executed out of order. These instructions turn the superpipelined design into a serious liability, forcing the processor to halt all other operations in order to complete execution of the single special instruction.

Among the special cases, full-register read operations can be stalled by a previous write operation to a partial version of the same register; for instance, an 8-bit portion of a 16-bit register. (Assembly-language programmers are probably familiar with using partial registers such as AL to hold single-byte values.) These partial-register references occur infrequently in 16-bit code but the impact they have on the flow of instructions through the processor is significant: In essence, these instructions may stall the processor for up to seven or more clock cycles, which means losing the opportunity to execute perhaps 20 *x*86 instructions. (Full-register reads following writes to 8- or 16-bit registers within 32-bit code can cause the same problem, but Intel says that most 32-bit code avoids such practices.)

Even more devastating is the impact of segment loads and I/O instructions, which not only stall the issue of subsequent instructions but also cause earlier stages in the pipeline to be completely flushed (see the diagram). All of these types of problems are characteristic of much of the 16-bit code that exists today.

entry-level pricing.

In a P6 system, choosing a memory subsystem essentially becomes a matter of selecting a 256K or 512K version of the P6 processor; manufacturers no longer can make the same kind of price/performance trade-offs as in the past. Even the option of using EDO DRAM won't be available initially, because Intel's P6 PCIset—the core logic formerly known as Orion that ties the processor to memory and I/O buses—does not support EDO memory or its successor, burst EDO. Third-party core-logic manufacturers such as OPTi, SIS, and VLSI are unlikely to offer alternative chip sets until sometime in 1996.

Intel manufactures the L2-cache chip as well, citing the unavailability of suitable parts from external sources. Virtually all P6 systems that ship this year will use not just Intel processors, Intel cache, and Intel chip sets; they will contain Intel-designed motherboards as well. In fact, one-third to one-half of systems' value will likely come from Intel-supplied components.

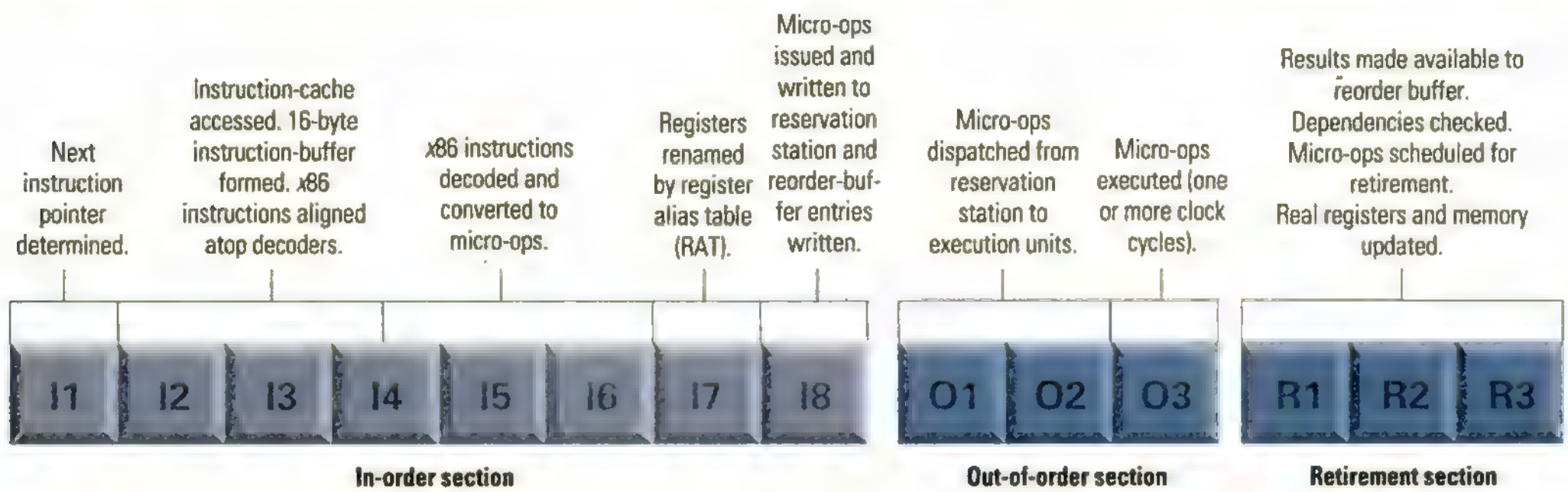
First-tier system vendors, particularly Compaq, have taken pains in the past to differentiate their machines with custom-designed system architectures. But designing and testing custom architectures is resource-intensive and time-consuming; few vendors will be willing to sacrifice sales immediately following the P6's introduction. These time-to-market constraints will compel even the traditional holdouts to use Intel-supplied motherboards through the end of this year.

What can you expect to find inside a P6 machine? In rough terms, the components will be similar to those in a high-end Pentium system: lots of RAM, big hard disks, fast graphics cards. P6 systems will aggressively embrace PCI; in many cases they will employ *PCI-bridge* technology to chain together two PCI buses and provide six PCI slots rather than the three to four slots available in most systems today. ISA slots will still be available for com-

P6 Pipeline Design

GENERAL OPERATION

The P6 uses a 14-stage pipeline divided into three sections: in-order, out-of-order, and retirement. The in-order section is decoupled from the out-of-order section via micro-op buffering in the reservation station. Decoupling permits the three sections to operate somewhat independently, improving concurrency.



PERFORMANCE ISSUES

With 32-bit code, the P6's decoupled, out-of-order design should provide performance modestly better than that of a Pentium at the same clock speed. But existing 16-bit code can generate pipeline stalls and force pipeline reloads that can sap performance so that the P6 may not run as fast as a Pentium. A partial-register stall occurs when an instruction performing a partial-register update resides in any pipeline stage after I7, and an instruction performing a full register access (a superset of the partial register) is encountered in stage I7. A partial-register stall forces all instruction accesses and decoding in stages I1 through I7 to be suspended until the partial-register operation proceeds through stage R3 and updates the architectural register.

When a segment-register load or an I/O instruction is encountered in stage I7, the in-order section is stalled while micro-ops in the out-of-order and retirement sections are processed through the retirement section to completion. The segment-register load or I/O instruction then proceeds by itself through the rest of the pipeline stages and fully retires. Also, instructions presently in the in-order pipeline are flushed and reloaded with the proper new target instructions.

Intel says it considered altering the processor's design to enable better handling of 16-bit code but concluded that implementing the changes would be impractical or prohibitively expensive. Competing processors from AMD, Cyrix, and NexGen do not appear to encounter the same limitations.

MAINSTREAM USERS: STICK WITH THE PENTIUM

Users who aren't ready to make the transition to working in a fully 32-bit environment will want to stick with the Pentium for the foreseeable future. In fact, Intel will likely announce an enhanced version of the Pentium, code-named the P55C and equipped with larger L1 caches, later in the year to fill precisely this demand.

Even those users who are ready to make the switch to 32-bit programs and 32-bit operating systems will need to evaluate price/performance trade-offs carefully before settling on a P6 system.

HIGHLIGHTS

The P6 Processor

INTEL'S P6 PROCESSOR, the next-generation successor to the Pentium, is targeted toward high-end users running 32-bit applications and 32-bit operating systems such as Microsoft Windows NT. Performance in this best-case scenario may be 40 to 60 percent faster than a Pentium's. Existing 16-bit code still runs natively on the P6, but at only about the speed of a fast Pentium. For mainstream users, including those running Microsoft Windows 95, the Pentium will remain the processor of choice.

THE FIRST P6 SYSTEMS—both desktops and servers—should be available this fall. The initial implementations will almost universally use Intel-manufactured motherboards built around the P6 PCIset (briefly known by its original code name, Orion). Expect prices to start at about $5,000 for fully configured machines.

"DYNAMIC EXECUTION" allows the P6 to process instructions more efficiently than a Pentium in most cases. The processor uses an out-of-order design that can execute three instructions per clock cycle with fewer stalls than the Pentium (except with 16-bit code). The P6 also supports register renaming and improved branch prediction. Internally, the P6 converts instructions into RISC-like micro-ops that avoid many of the problems inherent in the *x*86 instruction set. But the P6's superpipelining also imposes performance penalties when running today's 16-bit code.

THE P6'S PACKAGE is unique: Its dual-cavity design incorporates both the CPU itself and either 256K or 512K of L2 cache that runs at full processor speed. The cache bus is separate from the main-memory bus, and both L1 and L2 caches are nonblocking. The P6's main-memory bus can run at various fractions of the CPU's clock speed, which will start at 133 MHz and 150 MHz.

MULTIPROCESSING DESIGNS look promising: Up to four P6s can be directly connected with no additional logic, and the P6 employs a transaction bus that allows overlapping I/O operations and accesses to main memory for optimal performance.

x86 Processor Generations

The P6 employs a number of design techniques found in high-performance RISC processors to boost performance when running 32-bit cache. It is the first x86 CPU to include L2 cache in the processor itself.

■ YES □ NO	P6	Pentium	486
Runs existing x86 code	■	■	■
Register size	32 bits	32 bits	32 bits
Data-bus size	64 bits (plus ECC)	64 bits	32 bits
Address-bus size	36 bits	32 bits	32 bits
Number of transistors	5.5 million*	3.1–3.3 million	1.6 million (DX4)
Maximum number of x86 instructions per clock cycle	3	2	1
Out-of-order execution	■	□	□
Data forwarding	■	■	□
Dynamic branch prediction	■	■	□
Register renaming	■	□	□
Return stack	■	□	□
On-board L1 cache size	8K code, 8K data	8K code, 8K data	8K or 16K unified
On-board L2 cache size	256K or 512K	N/A	N/A
Nonblocking cache	■	□	□
Transaction bus	■	□	□
Native multiprocessor support	4-way split cache	2-way shared cache	None
Integrated floating-point unit	■	■	■ (some models)

* CPU only. L2 cache contains another 15.5 million transistors (256K version) or 31 million transistors (512K version).
N/A—Not applicable. The chip does not have on-board L2 cache.

patibility with older or slower peripherals.

How much will P6 machines cost? The processor's 5.5 million transistors in the CPU chip alone—nearly double the number in the Pentium—will make it large and therefore expensive to manufacture. The integrated L2 cache (which contains another 15.5 million transistors for the 256K version or 31 million transistors for the 512K version) is expensive as well. We expect volume pricing for the P6 to fall somewhere from $1,200 to $1,600 per chip in the initial versions. By contrast, 133-MHz Pentium processors sold for $935 apiece in lots of 1,000 prior to August 1 price cuts, and 256K of SRAM averaged around $100.

At a system level, that translates into prices of about $5,000 for systems with 16MB of RAM, 2GB hard disks, and 17-inch monitors. Stripped-down P6 systems may appear priced as low as $3,000, but given the applications that the P6 targets, we don't recommend skimping.

You might wonder whether Intel would consider moving the L2 cache outboard to allow lower-cost (and lower-performance) versions of the processor. Intel says that is unlikely, that moving the cache off-chip imposes too much of a performance penalty. And given the continuing speed improvements in the Pentium-processor family, it's not clear that the price/performance ratio of a P6 machine with external L2 cache would be compelling compared with the alternatives. Still, it could happen.

SERVERS: A BOLD STEP FORWARD

The P6 does represent a tremendous opportunity for servers, particularly the CPU-hungry application servers often used to run SQL databases and the like. That's not only because of the processor's raw computational ability, but also be-

Our Contributors: SEBASTIAN RUPLEY is a senior editor and JOHN CLYMAN is an associate editor at *PC Magazine*. NICK STAM is technical director for hardware at PC Magazine Labs.

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Video Memory/Max.	1MB/2MB	1MB/2MB	1MB/2MB
Compaq 150 Color Monitor	Yes	Yes	Yes
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots (Total)	3	5	4
Drive Bays (Total)	3	5	4
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes
101-Key Keyboard, Mouse	Yes	Yes	Yes
Software Preinstalled	MS-DOS® 6, MS-Windows 3.1	MS-DOS 6, MS-Windows 3.1	MS-DOS 6, MS-Windows 3.1
Energy Star Compliant	Yes	Yes	Yes
Warranty†	3-Year	3-Year	3-Year
Price*	$1,949	$3,354	$3,579

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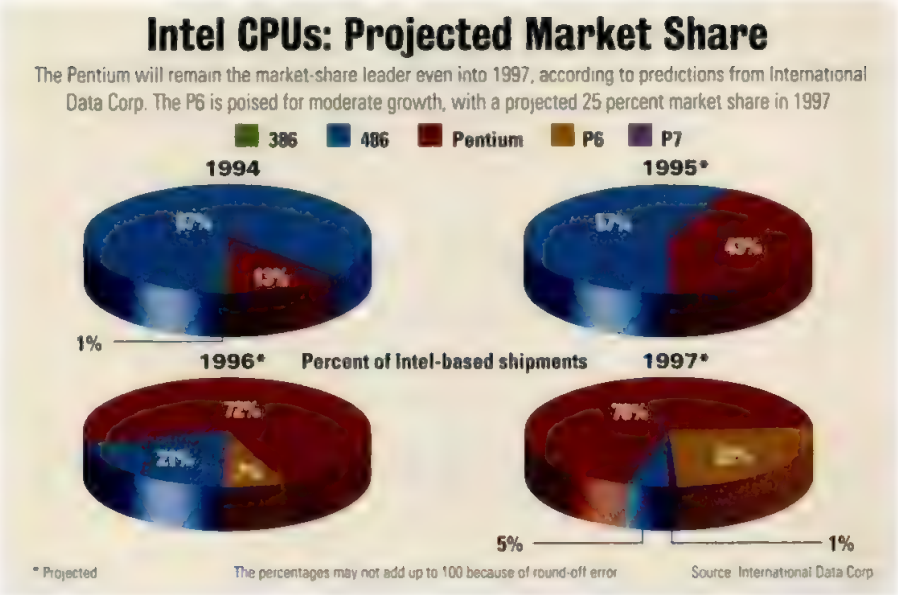
cause of its high-performance bus. Although multiprocessing Pentium servers are feasible, the P6 makes larger-scale multiprocessing designs much more straightforward.

To begin with, the P6 supports glueless four-way symmetric multiprocessing. *Glueless* means that no additional logic is required to support as many as four CPUs; they already contain all the circuitry required, and—in theory—building a multiprocessing P6 server is as simple as wiring together the pins on the multiple CPUs. The reality is more complex, of course, because properly balancing electrical loads and providing the copious airflow required to keep multiple P6s cool is no small task. But the bottom line is that you can expect to see a proliferation of multiprocessing servers based on the P6 around the end of the year.

From a performance perspective, the P6's approach to multiprocessing has a lot to recommend it. The processors' individual caches should be more efficient than the shared-cache design used in most dual-processing Pentium servers. And thanks to the P6's transaction-oriented bus, *clustering* of multiple server boxes is supported rather easily. Networks of multiprocessing P6 servers connected with a high-speed data link such as ATM or Fibre Channel could be constructed to provide high-end application-server platforms.



SOFTWARE IMPLICATIONS

The link crucial to the P6's success is actually not hardware but software. Even when the Pentium was first introduced, Intel implored software developers to recompile their applications—that is, take existing program code and retranslate it into machine language in ways that could exploit the superscalar capabilities of the Pentium without sacrificing backward compatibility.

Few developers ever bothered to recompile. Still, that did little to slow the acceptance of the Pentium, which provided a substantial performance boost over the 486 nevertheless. With the P6, the story is somewhat different: The bulk of today's existing 16-bit software simply won't run faster on the P6 than on the Pentium, according to Intel. And the needed software conversion is far more involved than simply passing it through a new compiler. To exploit the P6 fully, current 16-bit applications and OSs require a significant rewrite.

What developers need to do is write 32-bit code rather than the 16-bit code that has dominated since the early 1980s. When introduced ten years ago, the 386 was the first *x*86 processor to support 32-bit code, which manipulates quantities four bytes at a time rather than two bytes at a time and overcomes many of the addressing limitations of early *x*86 processors. (The P6, by the way, is still a 32-bit processor, even though it communicates with the external world using a 64-bit data bus, as does the Pentium.) But demands for backward compatibility and the lack of a mainstream 32-bit operating system have delayed the development of 32-bit programs, except in specialized fields that demand every bit of performance from CPUs.

The bulk of today's existing 16-bit software won't run faster on the P6 than on the Pentium. Apps must be rewritten in 32-bit code.

The impending release of Windows 95, which fully supports 32-bit applications although it contains substantial 16-bit code itself, is likely to provide the impetus that software developers need. Already, Microsoft's own best-selling Word for Windows and Excel applications have been ported to 32-bit code to run under Windows NT. Most P6 systems will ship with Windows 95 or Windows NT and a 32-bit office suite already loaded. Still, many users will have substantial investments in key 16-bit applications that they may be reluctant to upgrade.

The most likely users of P6 machines will not be running office-automation software so much as high-end CAD, graphics, scientific-modeling, financial, statistical, and neural-networking applications. And in these categories, the P6's superior floating-point performance should be a plus. Aside from these application categories, the place Intel sees P6 truly advancing the state of the art in software is in multimedia. The P6 represents a crucial milestone in Intel's NSP (*native signal processing*) effort. NSP is a reference platform that consists of chip sets, drivers, and a real-time OS kernel and is designed to help provide multimedia functionality on the CPU without dedicated multimedia hardware. NSP doesn't spell the elimination of dedicated multimedia subsystems, but the marriage of the P6, the P6 PCIset, and Intel's NSP APIs (application programming interfaces) could substantially raise the minimum standard for natively processed multimedia. The P6 does contain circuitry in its floating-point unit that is designed to accelerate so-called multiply-accumulate sequences, which are frequently employed in signal-processing apps.

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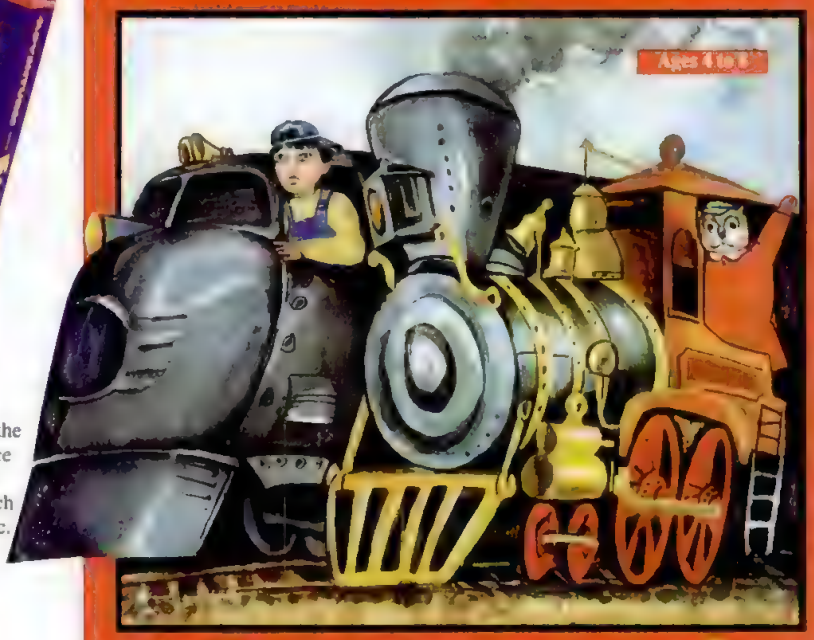

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Intel's Competitors and Where They Stand

By John Clyman

Intel still leads the *x*86 processor technology curve, but the chip-making giant's competitors are working hard to close the gap. AMD, Cyrix, and NexGen are all poised to chip away at the dominant position of the Pentium processor in the mainstream PC market.

Here's a look at where they stand today, along with an update on the one RISC processor family most likely to challenge P6 directly: the PowerPC chips jointly developed by Apple, IBM, and Motorola.

AMD

AMD's K5, due early next year, offers a P6-like design that supports out-of-order execution. The processor plugs into existing Pentium motherboards.

Conceptually, AMD's next-generation K5 processor looks remarkably like a P6 CPU mated to a Pentium bus. It was originally slated for delivery this summer, but it's now due in early 1996. The K5 converts *x*86 instructions into smaller operations (AMD calls them *ROPs*, or RISC operations) and uses an out-of-order execution engine—just like the P6. But the specifics are different: The K5 has four ROP converters that each can translate any *x*86 instruction, whereas the P6's micro-op converters are asymmetrical. The K5 also uses reservation stations in front of each execution unit rather than one unified, large reservation station. And the K5 employs a substantially different branch-prediction scheme.

Most important of all, the K5 is *not* superpipelined, so it should be penalized less heavily than the P6 by instructions that cannot be issued out of order.

Cyrix

Cyrix is boldly moving forward with its fifth-generation designs: the 5x86, for notebooks and entry-level desktops, and the M1, for high-performance desktops.

Cyrix is coming to market with two different Pentium-class solutions. The first is the 5x86, formerly known as the M1sc. The 5x86 promises Pentium-class performance by mating high clock speeds with capabilities such as branch prediction and data forwarding. The 5x86 is not, however, superscalar. The chip will initially be available with a 32-bit interface, with a 64-bit-bus version to ship early next year. The 5x86 will be targeted toward notebooks and low-cost desktops.

The follow-on to the 5x86 is the long-awaited M1 processor, which we expect will be called 6x86 to position it as a more direct competitor to the P6. The M1 *is* superscalar, and it adds dual pipelines, register renaming, and limited out-of-order execution. Cyrix expects to ship the M1 around year-end, and the company claims performance will exceed that of a Pentium by 30 percent or more.

NexGen

NexGen holds the distinction of having proffered the first Pentium competitor. Faster versions and PCI support should help increase its appeal.

NexGen was the first processor vendor to market a direct competitor to the Pentium. The Nx586 CPU, like both AMD's K5 and Intel's P6, converts *x*86 instructions into RISC-like internal instructions (NexGen calls them *RISC86 operations*). While the Nx586 is superscalar from a RISC86 perspective, it can execute no more than a single *x*86 instruction per clock cycle, so its design is substantially less aggressive than either the K5 or the P6 in that regard.

Like the P6, the Nx586 has a separate, full-speed bus dedicated to the L2 cache, although the L2 cache remains separate from the CPU. This design decision may provide a performance advantage, but imposes a stiff condition: The Nx586 cannot fit into a standard Pentium socket, nor can it use standard Pentium core-logic chip sets. As a result, NexGen is currently the only vendor with the interface logic needed to build a motherboard. But the company is finally shipping core logic that supports the PCI bus, which is far preferable to the VL-Bus–only initial version.

The Nx586 competes effectively with low-end and midrange Pentium processors, but we have not yet found NexGen capable of matching the fastest Pentium chips.

PowerPC

The PowerPC family is succeeding in Power Macintoshes, but can it compete against the Pentium? Native software is the key prerequisite.

The PowerPC, long touted as the most promising RISC alternative to the *x*86 architecture, is gradually gaining momentum. Microsoft is shipping Windows NT 3.51 for the PowerPC, making a somewhat mainstream operating system available, and a handful of vendors have announced PowerPC-based systems capable of running it.

The 132-MHz PowerPC 604, currently the fastest of the PowerPC chips, should compete well against the Pentium and perhaps the P6 from a performance standpoint. But there's a catch: In order to reach that performance level, the PowerPC 604 (and all other PowerPC chips) needs to run programs that have been specifically recompiled to support it. Like other RISC processors, the PowerPC family supports existing *x*86 programs only through emulation—in essence, a PowerPC machine running Windows NT uses a software translator that converts *x*86 instructions into PowerPC instructions.

That means PowerPC systems will be compelling only for users who are willing to run Windows NT and whose specific applications have been recompiled to support the PowerPC architecture. Today, that's a short list focused on markets such as high-end CAD and graphics. For mainstream PC users, though, the PowerPC will not be a viable option for years to come.

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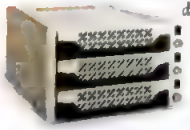

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PC MAGAZINE CIRCLE 106 ON READER SERVICE CARD

Intel cites applications including speech recognition, MPEG video decoding, video and sound mixing, and telephony as chief candidates for native signal processing on a P6. These apps push the limits of Pentium CPUs without additional hardware.

THE VALIDATION CHALLENGE

One of the biggest challenges in developing a processor is simply ensuring that it works properly. And the pressure on Intel is particularly great given the fiasco that surrounded last year's discovery of a bug in the Pentium's floating-point unit. As a result, Intel has stepped up an already-intensive validation and debugging process. In addition to testing trillions of instruction sequences on hundreds of machines, the company has instituted a user-test program that seeds early P6 systems to users of esoteric applications. Among the testers are specialists such as Dr. Thomas Nicely, the mathematician who first discovered the Pentium's flaw.

For most users, the price premium of the P6 processor and its affinity for 32-bit code makes a Pentium PC the best choice in today's market.

Even given the unprecedented degree of compatibility testing that Intel is performing, a device as complex as the P6 CPU is bound to contain some minor latent flaws. Should a bug be discovered after the shipment of the processor, the company pledges to document it in full immediately.

MOVING THE MARKET?

Does the introduction of the P6 spell the end of the Pentium? Hardly. We expect the P6 will initially receive a lukewarm reception because of its price premium and its affinity for still-scarce 32-bit software. Pentium-based PCs will clearly remain the best choice for most users—es-

GLOSSARY

Processor Terminology

Branch A point that represents a potential change in the flow of a program. A branch can either be *unconditional*, meaning that it always changes program flow, or *conditional*, meaning that it may or may not change program flow depending on some factor.

Branch prediction A processor's "guess" as to whether a specific branch will be *taken*—that is, will actually change the program flow.

Decode To examine the format of an instruction to determine what type of operation and which operands it specifies.

Dependency A condition that prevents one instruction from executing until another instruction has been finished. A *true dependency* occurs when one instruction's output becomes another instruction's input. *False dependencies* may be introduced by out-of-order execution but can be worked around through register renaming.

Execution unit A portion of the processor dedicated to performing a particular type of operation, such as arithmetic functions, memory loads and stores, or branch processing.

Fetch To retrieve code from cache or memory in preparation for decoding.

Floating point A system for representing any number as a single digit with a decimal fraction, along with a multiplier (an exponent of 2 or some other base number); for example, 1.23×10^4.

Instruction The fundamental unit of a program; one or more bytes of information that direct the processor to perform a particular task.

Micro-op Intel's term for RISC-like internal operations into which *x86* instructions are translated to improve processing efficiency. (RISC instructions tend to be much simpler and more consistently formatted than are *x86* instructions.)

Microcode A series of micro-instructions (sets of control bits) used to coordinate the execution of complex instructions by breaking them into smaller segments.

Nonblocking Allowing subsequent operations to proceed even if the first cannot be satisfied completely. The term describes caches that can continue processing even after a *miss*, which occurs when requested data is not present in the cache.

Out-of-order execution A methodology that allows instructions to be issued to execution units in an order different from that specified by the program. The instructions are reassembled into the proper order when execution is complete.

Pipeline An "assembly line" design where instruction processing is broken into many small steps or *stages* handled by separate circuits. When an instruction completes one stage, it progresses to the next, and the earlier stage begins work on the subsequent instruction.

Register A small, high-speed, on-chip storage area. In addition to special-purpose registers, *x86* processors have eight 32-bit general-purpose registers that hold values currently being used in calculations. Programs manipulate *architectural* registers. Because of register renaming, these architectural registers may be mapped to a larger number of *physical* registers within the processor.

Reorder buffer A structure that manages out-of-order execution by tracking the status of instructions that have been issued but not retired.

Reservation station A buffer that holds instructions that have been decoded but not yet executed.

Retire To commit results to architectural registers and memory. Instructions that are executed speculatively cannot be retired until it is certain that all dependencies have been resolved.

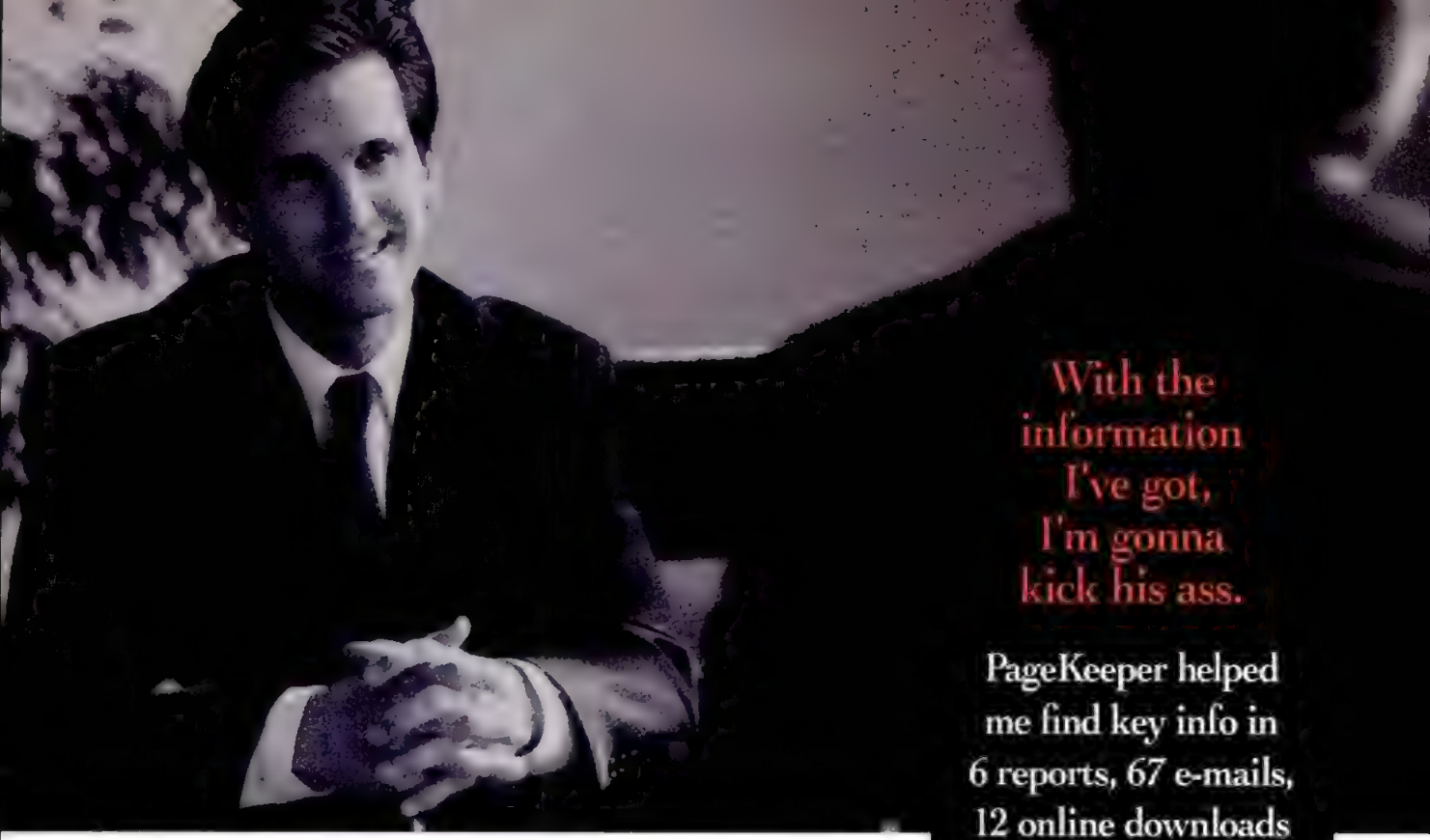
Serialize To force the processor to stall the issuing of instructions until a particular instruction has been retired. Serialization is required by certain instructions that cannot be processed out of order.

Speculative execution A methodology that allows the CPU to process instructions without being certain that they will ever be executed—for example, past a conditional branch.

Stall To halt a portion of a pipeline for one or more clock cycles.

Superpipelined Having a pipeline substantially deeper than the usual five or six stages. Superpipelined designs tend to allow higher clock speeds than other pipelined designs.

Superscalar Having multiple pipelines and being capable of executing more than one instruction per clock cycle (under ideal circumstances).



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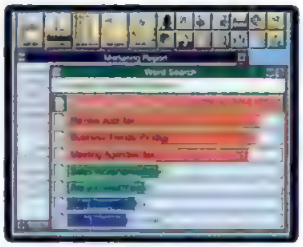

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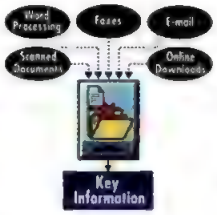

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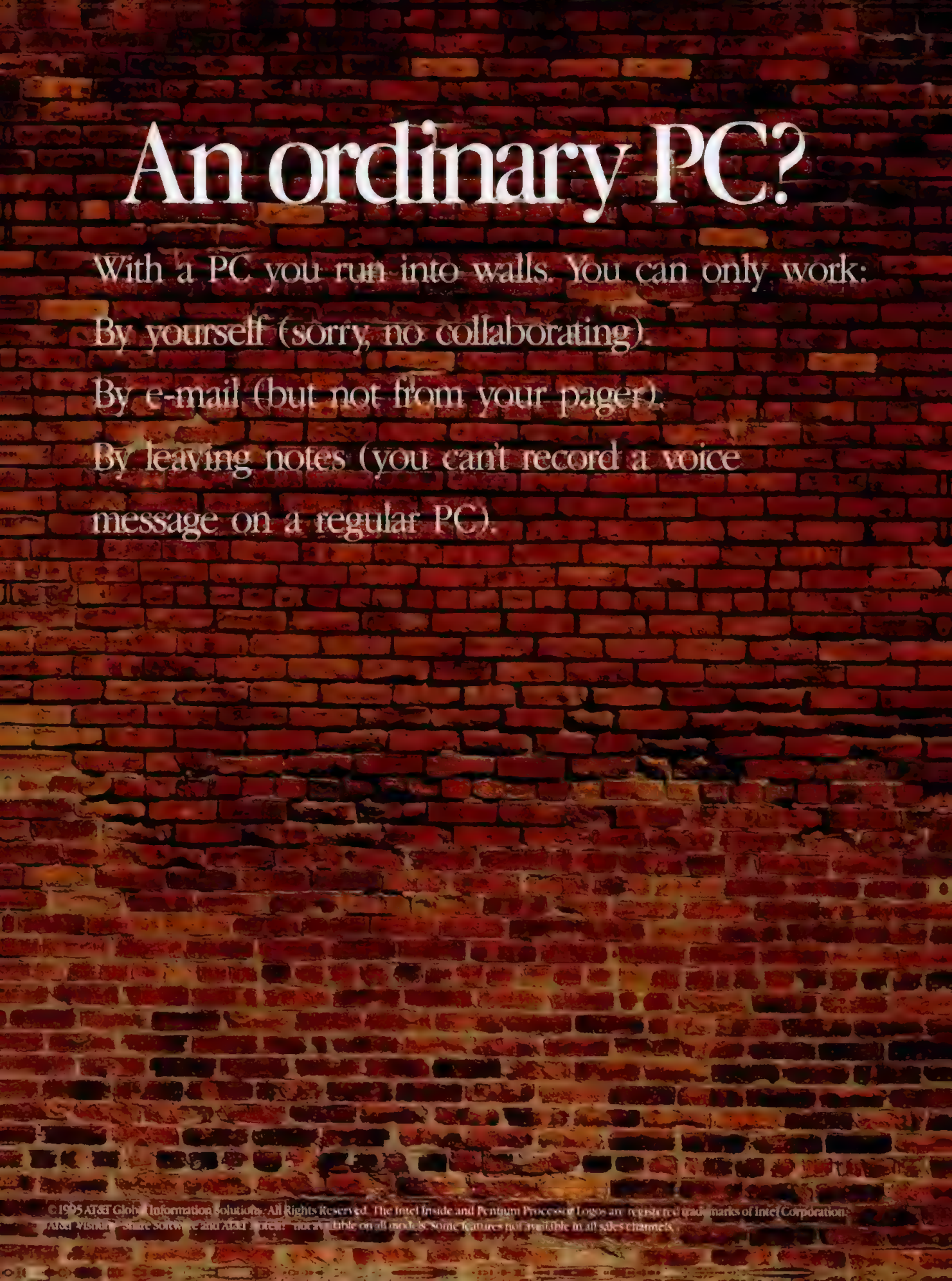
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pecially as Intel continues to churn out faster Pentium variants. The P6 will gain toeholds in the server market and in workstation-class PCs, where its advantages are clearer and price sensitivity is lower.

When Intel moves the P6 to a 0.35-micron process in 1996, pushing clock speeds to 166 or 180 MHz, the P6 may become more viable as a mainstream (albeit still high-end) processor.

Acceptance of the P6 may take time, particularly because of its affinity for Windows NT, OS/2, and Unix, none of which have a dominant market share on the desktop. Looking ahead a few years, we do expect that the P6 will ultimately displace the Pentium—just as the Pentium has surpassed the 486. The key will be the broad availability of 32-bit applications and mainstream 32-bit operating systems.

The first 12 to 18 months of the P6's availability will be devoted to ramping up production and increasing clock speeds. Stay tuned for comparisons of P6 systems as they become available in the next few months.

Inside the P6

The P6 implements nearly every performance-enhancing trick in the book. But this aggressive design has its downside, too. Here's a close-up look at the most complex x86 processor to date.

By Nick Stam

Designing a state-of-the-art processor is a high-tech balancing act: It means finding the right techniques to optimize performance without incurring such complexity that manufacturing becomes impractical. With the P6 processor, Intel has implemented an aggressive design that is both superscalar and superpipelined, supports out-of-order execution and register renaming, exploits branch prediction and speculative execution, and more.

Intel condenses all this technical jargon into a simple marketing term—"dynamic execution"—that refers to the P6's ability to optimize program execution by predicting program flow, choosing the best ordering of instruction execution, and speculatively executing the instructions.

The P6 also employs an unusual bus architecture, which among other features allows for an L2 cache that is built into the processor package and operates at full CPU speed (see the sidebar "The P6 Bus: Optimized for Speed, Multiprocessing").

The P6 is clearly optimized for 32-bit, not 16-bit, operation. When running 32-bit applications and 32-bit operating systems, the P6 promises to deliver performance about 40 to 60 percent faster than that of a comparably clocked Pentium, according to Intel. When running existing 16-bit code, however, the P6 will run slower than a comparably clocked Pentium. To illustrate why, let's examine the P6 microarchitecture in detail.

TWO PATHS TO PERFORMANCE

There are two design routes that can lead to a high-performing microprocessor. One is to design for a high clock speed; increasing the clock speed increases the number of operations that the CPU can perform in a given amount of time. Alternatively, increasing the parallelism of the processor lets it perform more operations during each clock cycle.

Intel opted to pursue both goals with the P6. The P6 achieves high clock speeds by virtue of a technique called *superpipelining*, while the P6's *out-of-order, superscalar* execution engine simultaneously manages to handle more instructions in each clock cycle than can a Pentium.

Superpipelining extends the basic pipelining concept that was first introduced to *x86* chips by the Intel 486 processor. Pipelined microprocessors execute instructions in an "assembly-line" fashion: Each instruction takes multiple clock cycles to process in full, but by breaking the processing into multiple stages and beginning to process the next instruction as soon as the previous instruction completes the first stage, a series of completed instructions can be produced rapidly. Most instructions in both the 486 and the Pentium traverse a standard five-stage pipeline.

Superpipelining divides the standard pipeline stages further; with more stages, each individual stage does less work and thereby needs less associated hardware logic. Reducing the complexity of the logic reduces *propagation delay*—the lag between the moment that a set of inputs is presented to a circuit and the moment a set of outputs is produced. With shorter propagation delays, faster clock speeds are possible: Intel reports that on a given fabrication process, the superpipelined P6 can run at a clock speed one-third faster than that of a Pentium processor. So when the P6 moves to the 0.35-micron process currently used for the 133-MHz Pentium processor, clock speeds of approximately 180 MHz should be easily within reach.

Superpipelining does have a serious downside. Instructions that force the P6 to flush its pipelines, which include mispredicted branches and operations such as segment-register loads (both described below), can dramatically reduce performance.

INSIDE THE PIPELINE

The P6 pipeline is complex, with a total of 14 stages divided into three sections. The *in-order front end*, responsible for decoding and issuing instructions, comprises 8 stages. The *out-of-order core*, which actually executes the instructions, has 3 stages.

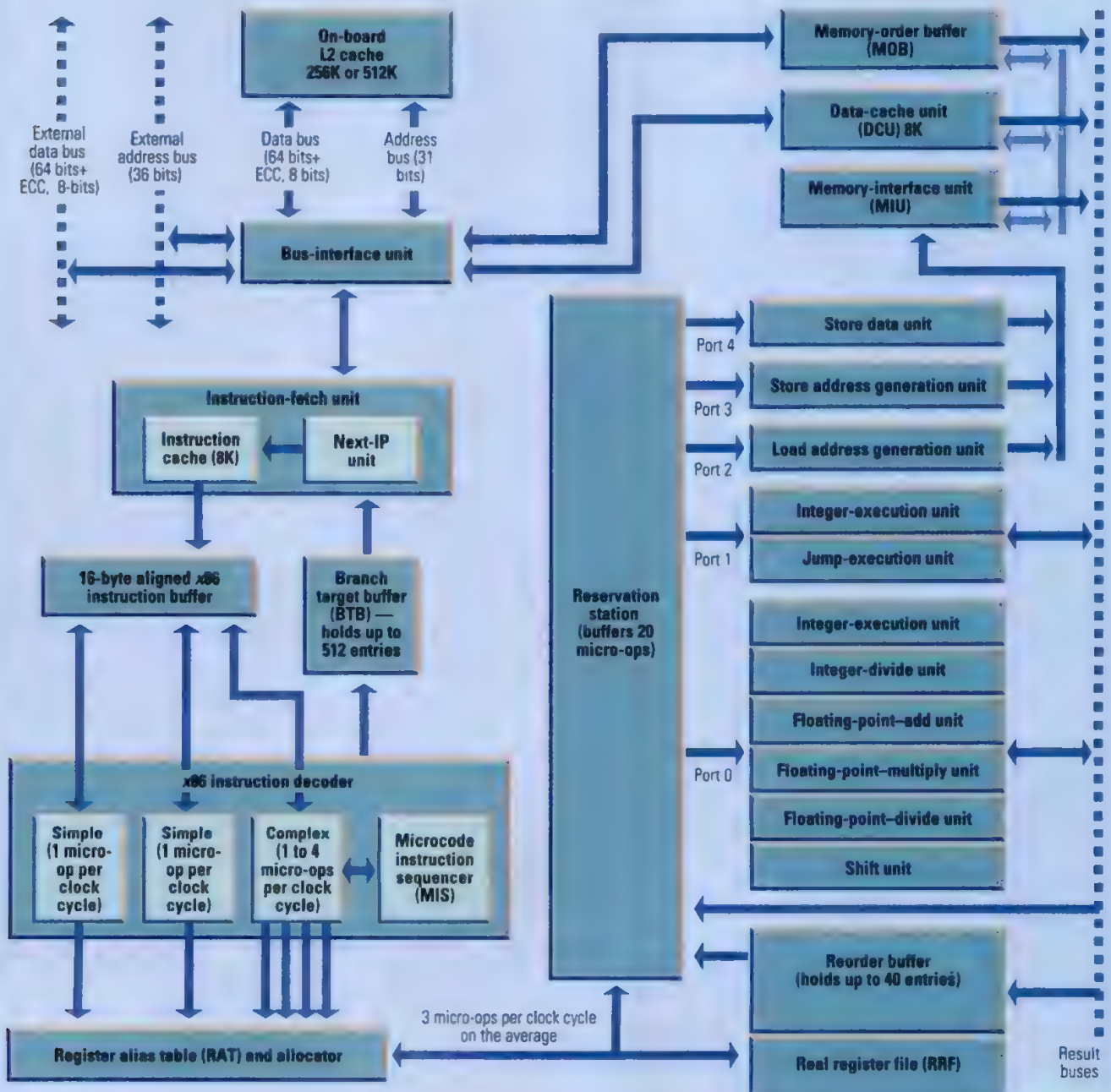
And the *in-order retirement* pipeline has 3 stages. The beauty of the P6 design is that it lets each of these three sections operate somewhat independently.

Whereas a basic pipeline allows a single instruction to be executed in each clock cycle, multiple pipelines can be combined in a superscalar design that can issue and execute more than one instruction per clock cycle. The Pentium was the first dual-issue superscalar *x86* processor. The Pentium had two separate pipelines—each with its own dedicated hardware—and could therefore execute up to two instructions per clock cycle. But the Pentium placed severe restrictions on the conditions in which two instructions could be issued simultaneously (which is why Intel said that recompiling code for the Pentium with these restrictions in mind was crucial to improving performance even further).

The P6 goes beyond the Pentium with its three-issue superscalar model. But the P6 doesn't simply add another pipeline to a Pentium design; it is a ground-up redesign. The P6 converts *x86* instructions into internal RISC-like operations called

How the P6 Works

The P6 fetches and decodes *x86* instructions and converts them into micro-ops, which are passed to the RAT. Then they enter the reservation station and the reorder buffer, traverse the out-of-order execution stages, and are ultimately retired.



micro-ops. These micro-ops avoid many of the limitations inherent to the *x*86 instruction set, such as irregular instruction encoding, register-to-memory integer operations, and variable-length immediate operands.

The micro-ops are eventually passed into an out-of-order execution engine, which shuffles them around so that instructions that are not ready to be executed won't clog up the pipelines and prevent later instructions from getting started. The P6's out-of-order engine is also *decoupled* from the initial stages of the pipeline. The decoupled design permits more effective superscalar operation with fewer pipeline bottlenecks and issue restrictions than the Pentium has.

X86-INSTRUCTION TRANSLATION

Fetching code and translating it into micro-ops occupies the first six stages of the P6 pipeline. The process begins when the P6 *instruction-fetch unit* reads 64 bytes of code (two cache lines) from the P6's L1 instruction cache as directed by the branch target buffer (BTB). The instruction-fetch unit looks at the current instruction pointer to locate the first *x*86 instruction and then takes the 16 bytes beginning with that location, aligns them, and passes them to three parallel decoders.

Why fetch 64 bytes when only 16 are used? Because the instruction cache is organized in 32-byte *lines,* and a line is the smallest unit of information that the processor can fetch from the cache. If the needed instruction appears near the end of the first cache line, the second cache line provides the remaining bytes necessary to fill the 16-byte buffer without delay.

The decoders proceed with the conversion of the *x*86 instructions into micro-ops. The P6 contains three decoders that operate in parallel, two of them "simple" and the other "complex." The simple decoders can handle *x*86 instructions that translate into a single micro-op. The complex decoder handles instructions that translate into from one to four micro-ops. Some particularly complex instructions cannot be directly decoded even by the complex decoder and are passed off to a microcode instruction sequencer (MIS), which generates as many micro-ops as necessary.

The simple decoder may encounter an instruction that it can't translate, in which case the instruction is eventually passed to the complex decoder or the MIS. This handoff delays decoding slightly but may not slow execution because of reservation-station buffering, discussed below.

The decoders are capable of generating a total of six micro-ops per clock cycle if complex and simple instructions are perfectly aligned with their respective decoders, but more typically three micro-ops flow out of all three decoders in each clock cycle. (This is the measure by which Intel claims the P6 is a three-issue superscalar engine.) Generally, these three micro-ops correspond to slightly fewer than three *x*86 instructions.

The P6 does not have to execute instructions in serial order; it can examine several and determine which are ready for execution.

REGISTER RENAMING

After the instructions are decoded and converted into micro-ops, the seventh pipeline stage sends them to the register alias table (RAT) for *register renaming.* Register renaming helps mitigate *false dependencies* that can sap performance in an out-of-order execution model. For instance, two instructions may need to write values to the same register; without register renaming, they could not be executed out of order, because the later instruction could not be processed until the earlier instruction was completed.

Dependencies like these are particularly common in *x*86 code because the *x*86 architecture specifies only 8 general-purpose 32-bit registers (by contrast, most RISC processors provide 32 or more general-purpose registers). With so few registers, the likelihood that two nearby instructions will compete for the same register is relatively high.

Register renaming involves converting a program's references to architectural registers into references to a larger set of physical registers. (The P6 actually has 40 physical registers implemented in the reorder buffer, described below.) In essence, the processor clones the limited number of real, architectural registers and keeps track of which clones contain the most current values. This prevents delays that false dependencies would otherwise impose because of conflicting demands for a register.

Register renaming cannot, however, work around true dependencies, which occur when the input to one instruction depends upon the output of a preceding instruction. In this case, there is simply no way to proceed until the needed output is available. (Still, techniques such as data and result forwarding can mitigate even the impact of true dependencies, and the P6 does implement them.)

OUT-OF-ORDER EXECUTION

After register renaming is complete, the micro-ops are sent to a structure called the reorder buffer (ROB, described below) and also queued up in a special instruction buffer called a *reservation station,* which is located between the decode and execute stages. Acting much like a reservoir, the reservation station holds a handful of decoded instructions so that the execution units can keep busy even if the decoders stall. Conversely, if the execution units are busy, the reservation station provides a cushion that allows the decoders to continue operating. (In rare circumstances, it is possible for the decoding stage to stall if the reservation station becomes full.)

The P6 can buffer up to 20 micro-ops in its single, centralized reservation station (more generally called a central instruction window) to service all of its execution units. The reservation station directly connects to all of the P6's 11 execution units. The reservation station can dispatch a maximum of five micro-ops per clock cycle, but with typical *x*86 code sequences, a sustained rate of three micro-ops per clock cycle is more likely.

The reservation station, in concert with the ROB, is what allows the processor to employ its out-of-order execution strategy. Essentially, the processor is freed from having to execute every instruction in serial order; it can instead evaluate multiple pending micro-ops and determine which are best suited for exe-

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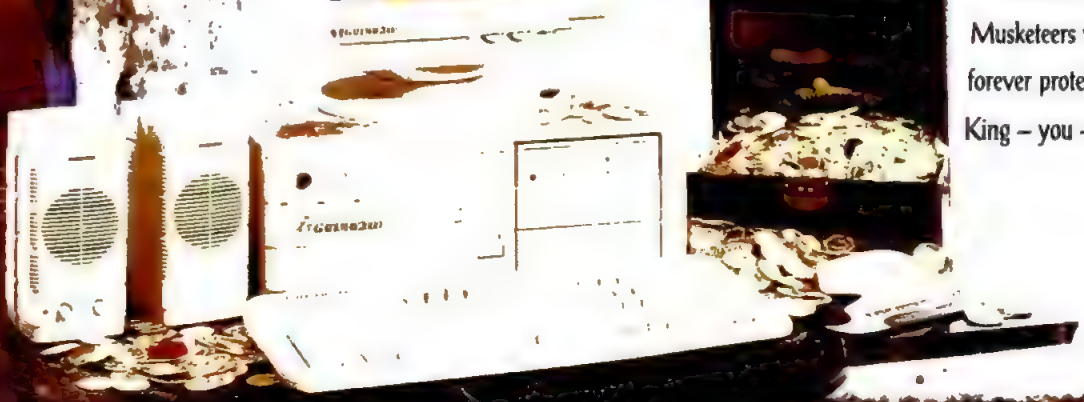

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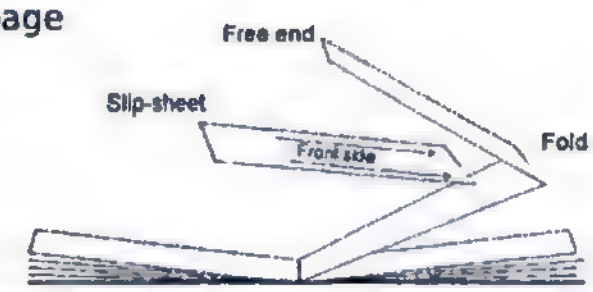

Inverted Foldout slip-sheet

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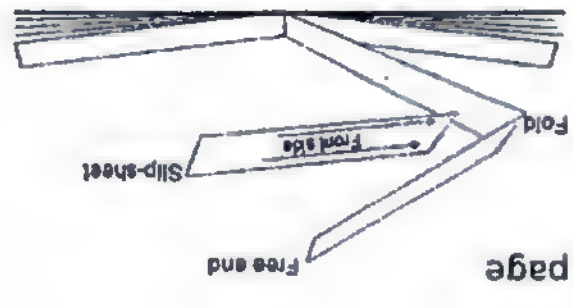

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Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

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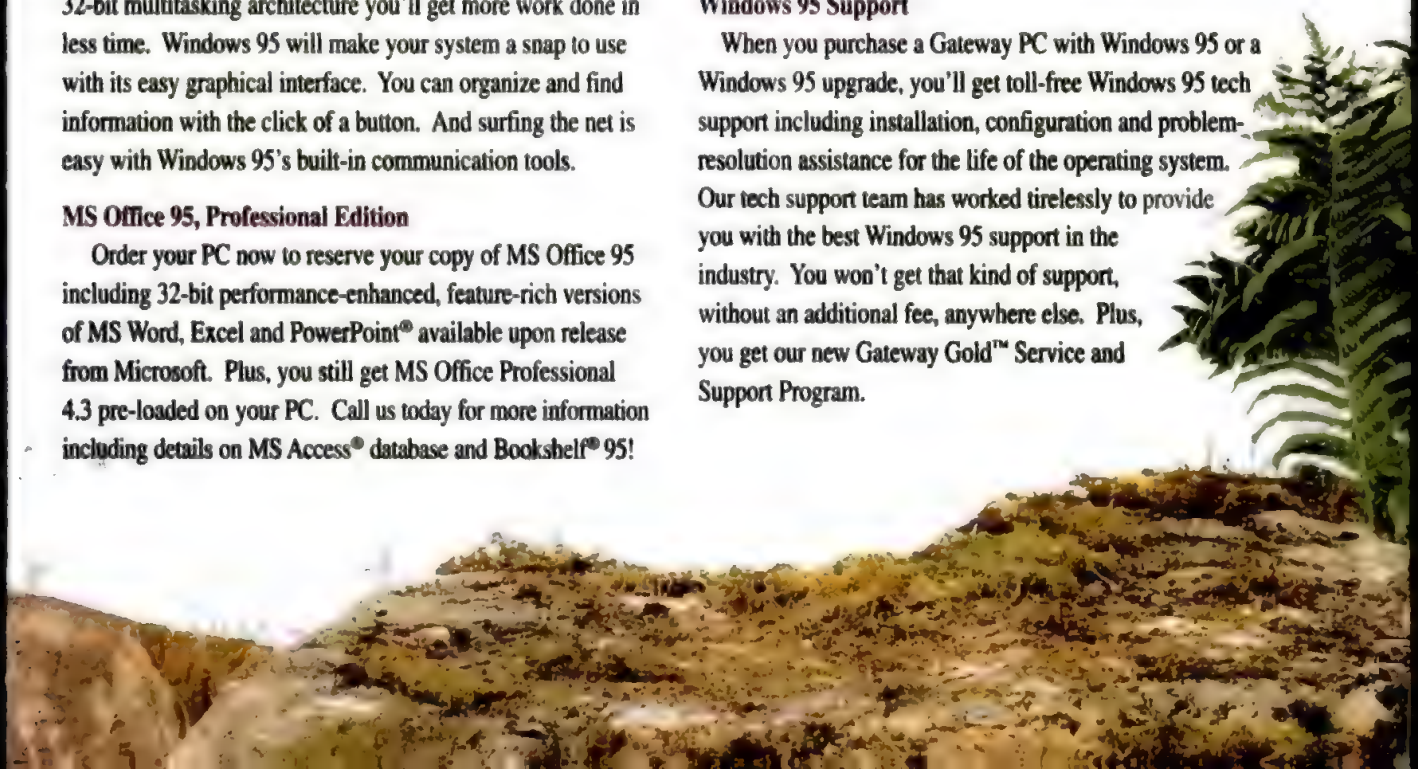

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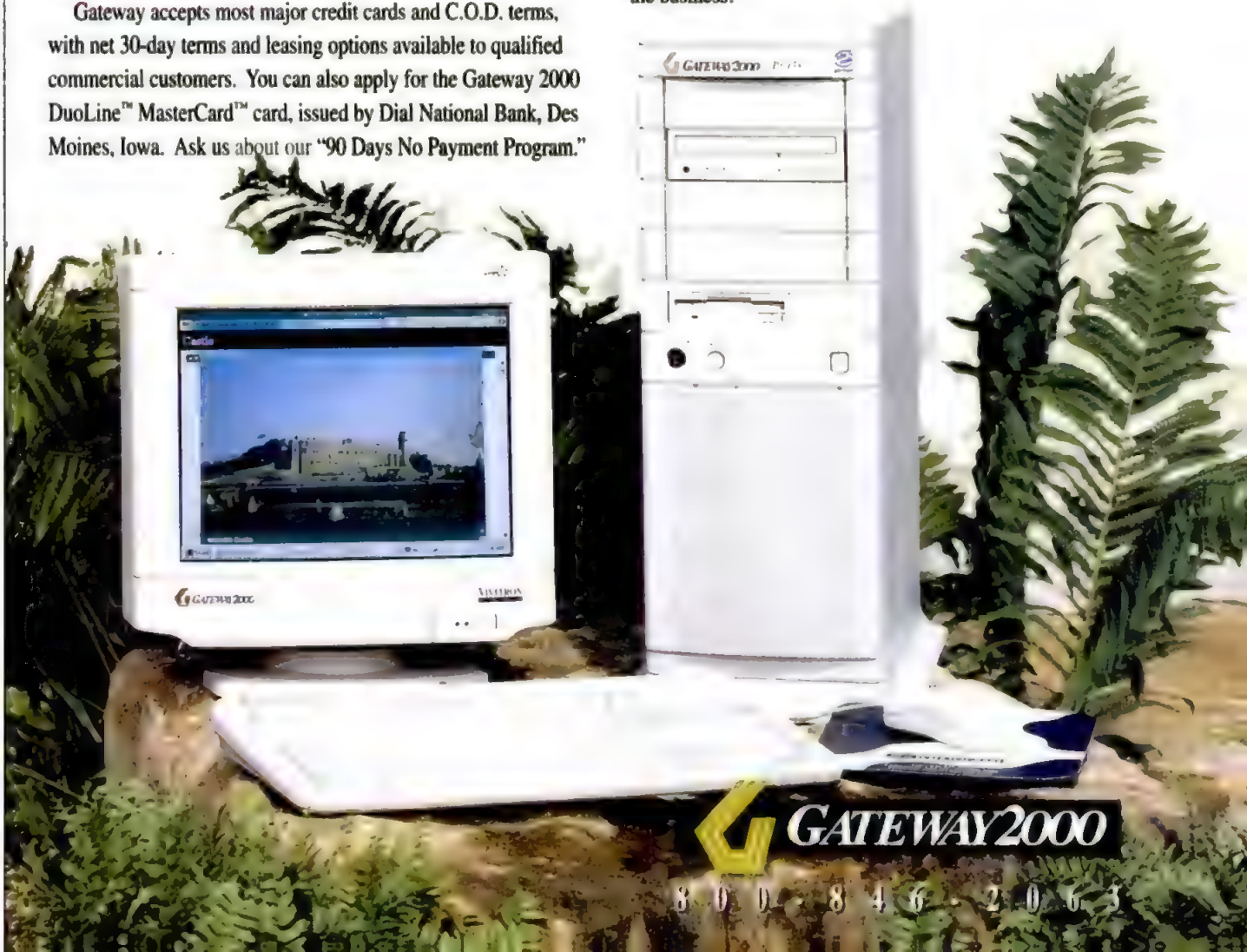

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cution at a given time. That determination can be made based on such factors as whether operands are available, whether needed execution units are busy, and whether dependencies have been resolved.

Although the term "out of order" implies that operations aren't completed strictly in the order a programmer intended, this isn't actually the case: Out-of-order results are calculated and stored in temporary buffers on the chip and are always written to architectural registers and system memory in program order. This is where the retirement stages of the pipeline, discussed below, come into the picture.

The P6 performs *data-flow analysis* to determine which micro-ops have all of their operands ready and can be dispatched to the execution units. In addition to the reservation station, the key structure in the P6 that helps manage data flow is the ROB. The ROB includes 40 entries, each 254 bits wide, that can hold a P6 micro-op with two associated operands, a result, and a number of status bits. Both floating-point and integer micro-ops can reside in the ROB.

RETIREMENT

Instructions that are executed out of order must ultimately be put back in order—otherwise, the processor would not always produce correct results. The ROB retains execution status and results of each micro-op. A micro-op is *retired* and the results are written to architectural registers and memory only when preceding micro-ops are known to have been completed.

The P6 Bus: Optimized for Speed, Multiprocessing

By John Clyman

One of the P6's most significant departures from previous *x*86 CPUs is in the way it interfaces with the external world. Internally, the P6 pulls out all the stops in terms of memory-subsystem design, as it discards the traditional partitioning of caches. And externally, the P6 bus dramatically enhances the way system memory, certain high-speed I/O devices, and other processors in a multiprocessor design are interfaced and accessed. (By *P6 bus*, we mean the processor's local bus, not the PCI bus that will be used to connect to most peripherals.)

Keeping a high-performance CPU running at full throttle means eliminating as many delays as possible—and one of the most devastating delays can come from wait states associated with accessing main memory that is far slower than the CPU itself. (Consider this: Dynamic RAM chips with an access time of 80 nanoseconds can't come close to keeping up with a processor running at 133 MHz and cycling about every 7 ns.) That is why processors since the 486 have typically been coupled with high-speed caches, both on-board (L1, or primary) and off-chip (L2, or secondary). By retaining frequently used instructions and data, the caches help keep the processor from stalling because information it needs to continue processing is temporarily unavailable.

The size of the L1 cache on the P6 is no larger than that on the Pentium: Both caches set aside 8K for instructions and 8K for data. The P6 can get away with this because its L2 cache design is unlike that of any mass-market processor. The P6's L2 cache is actually part of the processor itself, wired directly to the CPU chip at the factory. The performance advantages of a tightly coupled L2 cache eliminate the need for the L1 caches to balloon.

The P6's L2 cache is actually part of the processor itself, wired directly to the CPU chip at the factory.

The P6's L2 cache will be either 256K (manufactured on a 0.6-micron process) or 512K (manufactured on a 0.35-micron process). Either way, the processor communicates with L2 cache over a bus that runs at the full clock speed of the CPU itself, anywhere from 133 to 200 MHz and perhaps beyond. And the CPU itself maintains the cache *tags*, which indicate which information is stored in the cache. These factors mean the CPU can retrieve information from the L2 cache after only a single wait state. By contrast, even the fastest L2-cache subsystems in most Pentium systems typically impose at least two wait states when a memory access misses in the L1 cache.

To minimize the performance penalty associated with cache misses further, the L1 and L2 caches of the P6 are both *nonblocking*. When information that the processor needs is not contained in either cache, that doesn't impede the processing of subsequent cache accesses. (Up to four cache misses can be handled directly by the caches, and with assistance from the processor's memory-order buffer, up to 12 more memory accesses can be queued.) The nonblocking caches are particularly well suited for the P6's out-of-order execution core, because they allow much of the processor to continue functioning during long-latency memory operations that would otherwise stall the pipeline (as in the Pentium).

TRANSACTION BUS ALLOWS OVERLAPPING REQUESTS

The relatively large L1 and L2 caches help keep memory-access traffic on the CPU's external bus to a bare minimum; even so, Intel has taken great pains to remove potential bottlenecks in the memory subsystem. The external bus of the P6, like that of the Pentium, runs at a fraction of the CPU's clock speed: In this case, either one-half, one-third, or one-quarter of the CPU's clock speed. (The goal is to keep system design manageable by restricting bus speed to approximately 66 MHz.) And the data bus remains 64 bits wide (with an extra 8 bits added

Here's how the process works. After instructions have been decoded and registers renamed, the micro-ops are placed into the ROB—a circular FIFO queue—sequentially, in program order. This happens while the same micro-ops are being passed to the reservation station.

This sequential ordering process is essential for recovering the program order of micro-ops that are executed out-of-order speculatively. This ensures ordered updates of architectural registers and memory locations when execution is completed.

The fact that the ROB and reservation station both receive the same micro-ops at the same time from the decoders is an important element of the P6's design. While the ROB keeps track of micro-op program ordering, the reservation station buffers multiple micro-ops and determines when a particular micro-op is ready to be dispatched to its associated execution unit. (Micro-ops are ready for dispatch when they have all of their operands present.)

Results from previous micro-ops might be used as source operands for subsequent micro-ops, so all results are sent back to the reservation station from each execution unit. In fact, the P6 implements a complex interconnection network similar to a crossbar switch that ties all of the execution-unit output ports back into the reservation station. This allows results to be *bypassed* (or *forwarded*) to another execution unit that needs the result as an input operand, without a delay caused by updating and rereading registers.

Results from execution units also flow back to the ROB, which can determine

for ECC support, for a total data-bus width of 72 bits).

The P6 is innovative in the *way* it communicates with other devices connected to the bus, such as memory subsystems, other CPUs in a multiprocessor environment, and I/O devices. It employs a transactional bus design that supports multiple outstanding bus requests. For successive external-memory accesses, the chip is able to send a series of requests to main memory without having to wait for the reply to each; when the memory is ready to supply the needed information, the memory controller sends a response to the processor. Other bus transactions will not be blocked from executing if the memory subsystem is slow in replying.

Devices that are attached to the bus and can issue bus requests are called *bus agents*. (A P6 is considered a bus agent.) Up to eight transactions can be in progress across all bus agents, although each P6 can issue and track no more than four outstanding bus transactions. Additional transactions—up to 16 in all—can be queued within the bus-interface unit on the processor.

Intel even equipped the P6 with a mechanism that allows it to defer a bus transaction for a relatively lengthy period (ranging from microseconds to several minutes if the P6, associated chip set logic, and software are programmed to support such latencies). With respect to a particular agent, outstanding transactions will be resolved in the order they were issued to ensure correct operation.

Although delaying a memory access for a millisecond or more seems counterproductive—the processor would probably run out of things to do that aren't dependent upon that information—there is one case where this feature is particularly useful. That case is in large-scale multiprocessing systems.

The P6 intrinsically supports glueless four-way symmetric multiprocessing, meaning that building a multiprocessor P6 box conceptually entails little more than wiring together the pins of the various CPUs—no additional logic is required. And the CPU contains all of the necessary cache-coherency and bus-arbitration logic to allow this. (In fact, the bus controller on the P6 contains 89,000 transistors—far more circuitry than on the entire 8088 processor that powered the original IBM PC.)

Support for a delayed-response mechanism gives system designers the ability to extend the P6 beyond four-way multiprocessing. In particular, it enables a clustered multiprocessor design, where multiple four-way P6 machines are connected via a high-speed dedicated backbone using a technology such as ATM (asynchronous transfer mode).

The P6 is well positioned to play in these markets: It is compatible with all of the popular multiprocessor-capable operating systems and it implements the same Advanced Programmable Interrupt Controller (APIC) multiprocessor interrupt logic as high-end Pentiums.

SIGNALING DIFFERENCES

The P6 bus is so unusual that Intel's designers even decided to forsake the traditional TTL (transistor-transistor logic) electrical-signaling scheme that has been typical of PC buses for years. Instead, the P6 uses a scheme known as GTL+ (an extension of Gunning Transceiver Logic).

GTL+ provides many critical benefits. First, it allows multiple devices to access the bus simultaneously without causing electrical problems, a feature that is central to the P6's network-like bus architecture. Second, GTL+ is voltage-independent, which means that Intel can vary the voltage of P6 implementations without impacting system designs. Third, GTL+ requires a smaller voltage swing between high and low states than TTL, allowing for higher-frequency operations. And fourth, GTL+ has better noise immunity and longer signal-propagation characteristics, removing complex bus-timing interactions.

VOLTAGE-INDEPENDENT DESIGN

The voltage-independence of GTL+ is important because the P6 will eventually be available in numerous versions requiring different supply voltage. The P6 has four dedicated voltage-ID pins that provide a digital indication of the processor's required supply voltage. By connecting these pins into a variable-voltage regulator, system designers can use P6 motherboards that support processors that require anywhere from 2.4 to 3.4 volts.

The first 0.6-micron P6 chips will use a 2.9-volt supply, but voltages tend to decrease as processors move to smaller process geometries.

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whether a micro-op is ready to be retired. Retirement involves committing the results—updating the architectural registers and storing data to memory. The ROB ensures all micro-ops are retired in program order; the maximum retirement rate is three micro-ops per clock cycle, which nearly matches the average issue rate of three micro-ops from the decoders.

Writes to memory are also kept pending until the micro-op that caused them is retired. For this purpose, the P6 contains a memory-order buffer (MOB), which the memory-store units instruct to buffer data and address information. The MOB commits data to memory only when the ROB signals the MOB that the micro-op causing the memory write is retiring.

CERTAIN INSTRUCTIONS AFFECT 16-BIT PERFORMANCE

The potential benefit of the P6's out-of-order execution model is clear: It helps work around latencies that can impede the smooth flow of operations through the processor. But there are cases where this design has serious drawbacks. Certain instructions will force the in-order pipeline to stall, halting the issue of subsequent instructions until a particular instruction is processed through the remaining pipeline stages to completion.

Segment loads, I/O instructions, and control-register operations can wreak havoc with the performance of a processor such as the P6 that has multiple and deep pipelines. The P6 cannot execute these instructions out of order. When the processor encounters such an instruction, it therefore must halt instruction issue and allow the pipelines to "drain" (so that all partially executed instructions proceed to completion.) In addition, instructions present in earlier pipeline stages must be flushed and refetched. The bottom line: The processor loses dozens of opportunities to issue instructions.

Code can also generate severe stalls in the P6 by attempting to read from a register after an instruction has written to a portion of that register. In 16-bit code, for instance, writing a result to AL and then attempting to read AX (the 16-bit superset of the 8-bit register) can cause a stall of up to seven or more clock cycles if the instruction that performed the partial-register write has not yet been retired. In 32-bit code, reads of 32-bit registers that follow writes to 8- or 16-bit registers cause the problem as well.

Compilers can minimize partial-register stalls, but in handwritten assembler code, partial-register stalls are more common. The Windows 3.1 operating system, and portions of Windows 95, contains some handwritten assembler code that can cause partial-register stalls in the P6.

Partial-register and segment-load stalls can impose various levels of performance penalties. If a partial-register update is spaced many instructions away from the subsequent full register read, the stall may only last for a few clock cycles, since the partial-register update is close to retirement. But if the partial-register update is adjacent to a subsequent full register read, the stall will last at least seven clock cycles with respect to the decoder outputs. On the average, such a stall can prevent from 3 to 21 micro-ops from being issued, corresponding to as many as 21 *x*86 instructions.

Both the occurrence of partial-register stalls and what Intel calls "gratuitous" segment-register loads are largely why today's 16-bit applications will not run as efficiently as pure 32-bit applications on the P6. Some existing 16-bit code contains many partial-register references that can force a stall, and some 16-bit code contains many segment-load operations.

Intel made the decision to optimize the P6 for 32-bit code years ago, with the expectation that 32-bit applications would be commonplace by 1995. Intel later decided that eliminating partial-register stalls to improve performance on existing 16-bit code was not justified given the additional logic and design complexity required.

BRANCH PREDICTION

When pipelines run dry, performance suffers; that's why the P6's designers imple-

The P6 from a Programmer's View

By Nick Stam

From a programmer's perspective, not much has changed from the Pentium to the P6. The P6 has no new general-purpose registers and only one significant new instruction: CMOV, or *conditional move.* Conditional moves are supported by many RISC processors; they allow a compiler to minimize the number of performance-sapping branch instructions. But few programmers are likely to employ the CMOV instruction on the P6, since doing so would make their programs incompatible with earlier Intel CPUs.

The P6 also makes access to performance-monitoring registers on the chip easier than with the Pentium, but this will be a feature of interest primarily to compiler writers.

The P6's dynamic execution capabilities do mean that software optimizations are less critical to maximum performance than with the Pentium. But there are still some common-sense programming techniques you can use to help make the most of the P6:

Avoid reading a large register (such as EAX) after writing a smaller version of the same register (such as AL). This will cause the P6 to stall the issuing of instructions that reference the full register and all subsequent instructions until after the partial write has retired, which can noticeably reduce performance. (See the sidebar "Why the P6 Prefers NT" for details.)

Avoid branches wherever possible. Exploit the P6's return stack by using a RET rather than a JMP at the end of a subroutine. And try to make existing branches predictable by following the P6's static branch-prediction rules.

Align data properly. This optimization will benefit any processor.

Avoid self-modifying code. Code that alters itself can cause the P6 to flush the processor's pipelines and can invalidate code resident in caches.

These and many other optimizations are detailed for software developers in Intel's white paper called "Optimizations for Intel's 32-Bit Processors."

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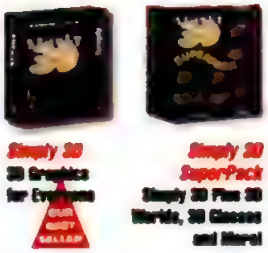

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mented a sophisticated branch-prediction scheme to minimize the impact of changes in program flow. Branches come in two varieties: *unconditional branches*, which always divert the program flow to a new target address, and *conditional branches*, which may or may not change program flow, depending upon the result of a comparison or another condition. (When a conditional branch is not taken, the program simply continues with the next instruction in sequence.)

In typical programs, up to 10 percent of instructions can be unconditional branches, and another 10 to 20 percent may be conditional branches. The unconditional branches are not a problem; the processor is certain they will be taken, so it just redirects its fetching to the target address. Conditional branch instructions are much more of a challenge, because the processor can't know whether the branch will be taken or not until the instruction completes the execute stage of the pipeline.

The P6 can predict the behavior of groups of branches, elevating branch-prediction accuracy to 90 percent.

But waiting until the branch instruction clears the execute stage means giving up lots of opportunities to fetch and issue instructions. The processor needs some kind of algorithm that lets it "guess" whether a branch will be taken or not. If it guesses right, execution continues with little or no delay. If it guesses wrong, then partially completed instructions must be flushed from the pipeline and new instructions fetched from the correct address, then decoded and issued. This imposes a significant performance penalty—a particularly acute one in processors such as the P6 that have multiple and deep pipelines. If the P6 guesses wrong, it can suffer a penalty of from 4 to 15 clock cycles.

The two basic branch-prediction methods are called *static* and *dynamic*. Static branch-prediction methods are simplistic; they always predict particular types of branches to be taken or not taken. Instructions in some processors (but none in the *x*86 family) contain a branching "hint" that a compiler can set based on its expectations of the program's behavior. But a more generally effective solution is a dynamic branch-prediction algorithm, which actually evaluates the execution behavior of branches over time (as the same branch is often taken more than once, as in a loop). From this historical insight, future predictions can be made more accurately. The P6 includes static methods to predict branch behavior for branches that have not yet been historically evaluated by the dynamic methods.

Like the Pentium, the P6 uses a structure called a branch target buffer (BTB), and both chips use prediction methods that rely on branch-history bits. But Intel claims branch prediction in the P6 is far more accurate: 90 percent, compared with 80 percent for the Pentium. (Another way of looking at this is to say that mispredictions occur only half as frequently on the P6—in about 10 percent of the cases rather than 20 percent on the Pentium.)

The P6 employs a two-level, adaptive history algorithm that not only captures history and predicts individual branches but can also predict the behavior of groups of branches. Intel has not detailed the design, although the company has indicated that the P6's BTB can predict four target addresses per instruction-cache line.

Most high-performance processors, including the P6, extend their branch prediction with *speculative execution*, the ability to execute instructions beyond a conditional branch instruction prior to knowing whether the branch's predicted outcome was correct. The processor must not update architectural registers or memory locations until all speculatively executed branch instructions are resolved. If any of the branches are mispredicted, the processor must be able to back gracefully out of any instructions performed beyond the branch points. To accomplish this, the P6's ROB simply flushes the speculatively executed instructions before they are retired. The P6, like other advanced processors, permits multiple levels of speculation by predicting and following more than one branch-target instruction stream.

The P6 also contains special logic to handle subroutine CALL/RET pairs, a

special type of branch. Since a subroutine can be called from many different points in a program, it's difficult to predict where the processor should continue fetching when a RET instruction is encountered. A prediction mechanism called a *return stack* helps alleviate the impact; the next instruction address after the call instruction, which is the proper return address for this particular subroutine call, is pushed on the stack. Therefore, the branch-prediction logic can signal that the proper instruction be fetched upon encountering a return.

FLOATING-POINT IMPROVEMENTS

The P6 implements a number of enhancements to the floating-point model used in the Pentium in search of better performance. The P6's floating-point unit is fully pipelined, so it should easily outperform the Pentium's when performing back-to-back floating-point operations. Also, the dynamic execution features of the P6 tend to mask the relatively long latencies of floating-point operations, which often take multiple clock cycles in the execute stage compared with one to two clock cycles for many integer instructions. Many other operations that perform useful work in the P6 can occur while the floating-point units are busy.

The P6 also addresses an Achilles' heel of the *x*86 floating-point architecture: Its reliance on a stack-based model. The *x*86 instruction set operates on values that sit atop a stack of operands, which means programs perform frequent FXCH (floating-point exchange) operations to access information elsewhere in the stack. The P6 contains dedicated FXCH hardware that effectively allows access to any item in the floating-point stack with no additional latencies.

Intel also worked to ensure that so-called multiply-accumulate sequences, at the core of many digital signal processing algorithms, would be executed rapidly.

BUT WAIT, THERE'S MORE. . .

There is no question that the P6 pushes the limits of superscalar designs today, and in fact there is far more to tell about its innards than we have space for here. The real question will be, How much performance benefit will real applications derive from all the architectural enhancements? Visit our on-line sites (listed on the opening pages of this story) for performance data. □

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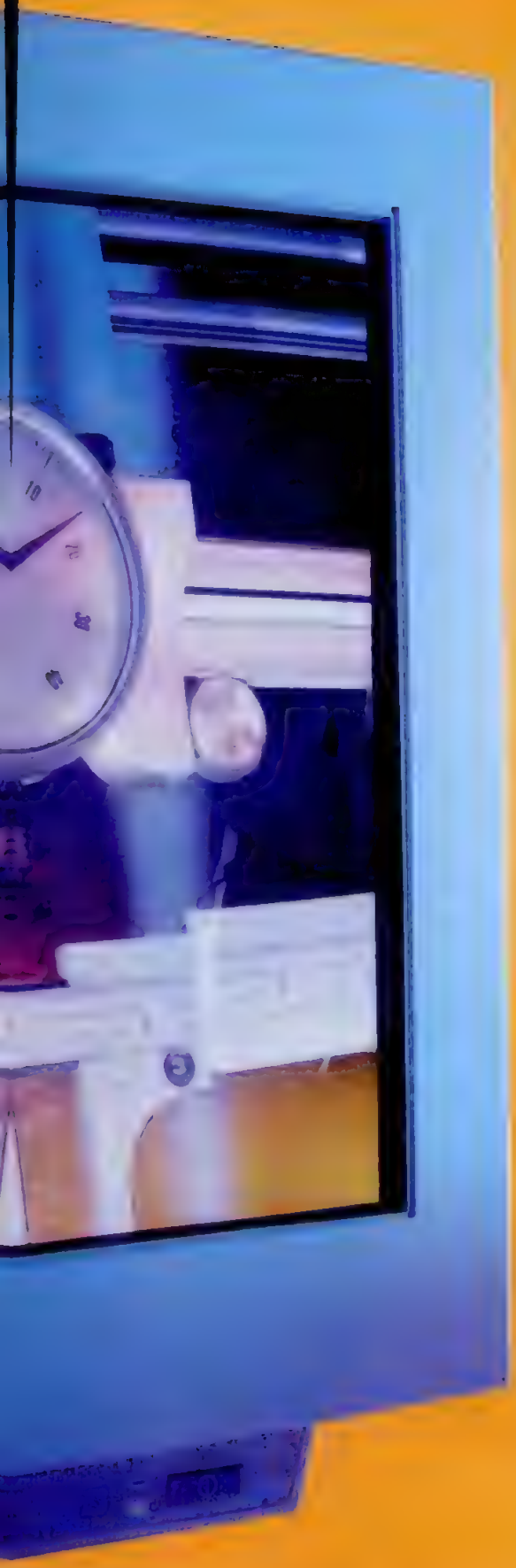

BIGGER WINDOWS

For as little as $599, you can now upgrade to a 17-inch monitor that will let you spread out your spreadsheets and see more of your multitasked tasks.

By John R. Quain

The last thing you should notice about your system is the monitor. If you find yourself paying more attention to the screen itself than to what's on it, either your monitor is losing its focus or you're running out of screen space. Either way, it may be time to move up to a 17-inch monitor.

Anyone who works with large spreadsheets, multitasks in Windows, or zaps alien ships in Descent will appreciate a 17-inch display. The monitors in this roundup had an average viewable image size (diagonally) of 15.8 inches, compared with 13.8 inches for the monitors in our latest roundup of 15-inch monitors. The extra 2 inches typically yields 28 percent greater viewing area than the average 15-inch display provides. And while most users find 800-by-600 to be the maximum comfortable resolution for a 15-inch screen, those with 17-inch units will be able to jump up to 1,024-by-768. This yields more windows, icons, and text on the screen at one time.

With street prices averaging around $850 and in some cases as low as $599, 17-inch monitors represent a good compromise between $2,000 21-inch displays and $300 15-inch models. And buying a 17-inch display with your new PC will cost only $200 to $300 more than a system equipped with a 15-inch monitor.

Last year, 17-inch models accounted for about 15 percent of the worldwide monitor market in terms of unit sales, according to Dataquest, a market research firm located in San Jose, California. By the end of this year, they will represent about 18 percent and next year, approximately 25 percent.

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Unfortunately, while sales may be on the rise, so are some prices—at least temporarily. Several factors have contributed to, in some cases, a price rise of up to 15 percent. Shortages of the glass used for tubes and of the plastic used in chassis combined with a rise in the price of copper (which is used in significant amounts in monitors) have prevented manufacturers from lowering prices. This was further aggravated by the weakening dollar and by the disruption in distribution and manufacturing caused by the earthquake in Kobe, Japan, which diverted some of the already scarce glass into television manufacturing. The quoted prices in this roundup (which range from $599 list for the TVM AS6G to $1,410 for the IBM 17S/S) reflect these factors, but buyers may still see some price fluctuation. Most monitor makers hope that the component scarcity will ease later this year so that prices start to fall again.

REVIEW CRITERIA

For this year's roundup, we requested 17-inch (measured diagonally) monitors that were *MPR II*–compliant and could display a minimum resolution of 1,024 by 768 pixels with a *vertical refresh rate* of at least 72 Hz. MPR II is a standard published by SWEDAC (the Swedish Board for Technical Accreditation) that specifies maximum acceptable levels of potentially harmful extremely low frequency (ELF) and very low frequency (VLF) monitor emissions. Most monitors on the market today adhere to MPR II. Nine of the monitors we tested adhere to the even more stringent TCO emissions requirements; six offer TCO compliance as an option.

The vertical refresh rate refers to the number of times the screen is redrawn every second. Over a year ago, the Video Electronics Standards Association upgraded its standard specification for refresh rates from 72 Hz to 75 Hz. Two of the monitors we reviewed—the Delta Socos DA-1765VAF and the Kenitec 617ADX—reach only 72 Hz at 1,024-by-768. The rest reach at least 75 Hz.

We also looked at one monitor that didn't quite fit our filter—Orchestra Multi-Systems' Tympani, which has a huge, 0.42-mm dot pitch and runs at 1,024-by-768 with a refresh rate of only 60 Hz instead of our required 72 Hz (see the sidebar "Orchestra's Ensemble"). The Tympani sells for a spectacular $469 (street price), but its performance is less than adequate for most uses other than games.

The monitors we tested had to be shipping during our testing period, which ran from late April to late June 1995. The following monitors didn't make it in time for testing: ADI Systems' MicroScan 5AP ($859) and MicroScan 5EP ($769), a new version of Amax Engineering Corp.'s Impression7 ($699), Corian Industrial Corp.'s ArtMedia TC 1864 ($899) and ArtMedia TC 1882 ($1,099), Daytek Corp.'s DT-1730 ($599), Hitachi America's Accuvue Galaxy GX-17L ($999), Mitac International Corp.'s Mitac L1782 ($689), a new version of Nissei Sangyo America/Hitachi's SuperScan Elite 17 ($1,049), Philips Consumer Electronics Co.'s Magnavox MagnaScan ($849), Portrait Display Labs' Pivot 1700 ($995), Proton Corp.'s GM-1764 A ($619), Qume's QM1791 ($955), Samtron Displays' Samtron SC-728SXL ($950), Tatung Co. of America's Audio 17 ($850) and Tatung CM-17MLP ($950), and Wen Technology Corp.'s Wen JD-178 ($999).

We subjected each monitor to both objective and subjective tests. To determine objective measurements of image quality, ZD Labs used a MicroVision SpotSeeker III and a Minolta Color Analyzer CA-100. The results of these labs-based tests determine the overall image focus and accuracy of the monitor. They judge the focus of a monitor's three electron guns (red, blue, and green) expressed as *misconvergence*—the amount of deviation from perfect alignment. Misconvergence can make text and fine edges appear fuzzy and indistinct. Look for monitors with the lowest amount of misconvergence; consider any model with a misconvergence score higher than 0.20 mm on our tests to be undesirable.

Another good measurement of a monitor's overall sharpness is its *MTF* (*modulation transfer function*) score, which represents the ratio of contrast to maximum usable brightness. Look for a monitor

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with an Average MTF score greater than 35 percent.

The other prominent labs test focuses on pincushioning. This is the amount of curvature exhibited by straight horizontal and vertical one-pixel wide lines. Once again, look for lower scores: Anything below 0.60 mm is acceptable for horizontal lines; vertical results should be lower than 0.50 mm.

When scanning the test results, bear in mind that no monitor can achieve a perfect score on all the tests. While attempting to achieve the best focus, for example, a monitor maker may sacrifice a little brightness to keep a monitor's electron guns from overshooting their mark.

Due to this balancing act, each monitor model tends to have its own personality. More important, the tradeoffs that are made between different aspects of a monitor's display aren't necessarily apparent in the objective measurements, though they are often obvious to the naked eye. So to judge how well each monitor's overall image appears to human eyes, our reviewers conducted extensive, hands-on subjective tests. We examined each display using a variety of 24-bit-color 1,024-by-768 graphics files and test patterns. We also used DisplayMate for Windows, from Sonera Technologies (800-932-6323), a $79 program designed to reveal geometric and color distortion on monitors.

To see how well the monitors we received measured up against those in stores, we selected a random sample of monitors from the roundup and purchased identical models from different retail outlets. The store-bought versions were then tested for comparison purposes. In every case but one, the store-bought monitors tested within an acceptable margin of deviation. Sampo Technology's AlphaScan 17gx was the exception: The store-bought model's Average MTF score was 49 percent, compared with 58 percent for the model the vendor sent. Though the store-bought version showed acceptable sharpness, the version the vendor sent us was considerably sharper. When we brought this issue up with the vendor, Sampo claimed that the monitor we had purchased was an older version than the one they sent us for testing and that several improvements had been made to the product since early 1995. We recommend

For home/small-office use:

• CTX 1765GMe

For mainstream business use:

• Samsung SyncMaster 17GLi

For CAD/graphics professional use:

• Nanao FlexScan T2•17TS

Culling 3 Editors' Choice monitors from the field of 43 we looked at for this story was no easy task. Most of the current offerings deliver a good mix of performance and features at reasonable prices. Price-sensitive buyers may have to forego fancy extras such as on-screen controls and Plug and Play compatibility, and the display's image may be less perfect than that of a more expensive model, but such monitors should still suffice. Our Editors' Choice recipient in this price strata is the CTX 1765GMe. This $649 (all prices here are estimated street) unit delivers a sharp, clear picture. We detected some convergence problems on our test unit, but for less demanding chores the 1765GMe is a strong choice. An honorable mention goes to the MAG InnoVision DX17F ($650), which equalled the CTX in almost every measure. Also deserving of merit are the MaxTech GVC M1766LR ($599), Panasonic PanaSync C-1791Ei ($699), and Orchestra's Tuba II ($699). While not flawless, these units were nonetheless solid performers and represent excellent values.

Advantages of a more expensive monitor typically include easy-to-use on-screen controls to adjust screen attributes and a crisper display with excellent focus. The traditional market leaders in this segment, from NEC, offer good image quality and convenient features, but other monitors offer more bang for the buck than the current NEC lineup. For one, the new Samsung SyncMaster 17GLi ($699) garners Editors' Choice this year. This Samsung unit impressed us both on our labs-based and subjective evaluation, exhibiting a bright, sharp picture and good color saturation. The 17GLi's display image might even prove good enough for desktop publishing work, and it delivers such extras as Plug and Play compatibility and on-screen controls—even though its price matches that of many bargain-bin brands. Again, we found a handful of fine runners-up you should also consider, including the LG Goldstar 1727 ($800), Hyundai DeluxScan 17 ($799), NEC MultiSync XV17 ($795), Sampo AlphaScan 17gx ($725), and ViewSonic 17GS ($795).

Detailed work requires a near-flawless picture, so graphics, CAD, and desktop publishing professionals will probably need to opt for a high-end monitor. The Nanao FlexScan T2•17TS ($1,149) was our favorite. It's not cheap, but the sharpness of the T2•17TS's DiamondTron vertically flat CRT was nearly unbeatable. Colors were vibrant, and you get Nanao's excellent image-control facilities. Zenith Data Systems' ZCM-1740 ($899) merits an honorable mention. The Trinitron tube delivered bright, bold images, and the Zenith is a relative bargain among high-end monitors. Buyers of this class of monitor should also look at Nanao's FlexScan F2 17 ($970), as well as the Mitsubishi Diamond Pro 17TX ($1,149), Nokia Multigraph 447X ($999), and Samsung SyncMaster 17GLsi ($949), all of which deliver excellent image quality.

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Dell's featured digital artist is Sanjay Kothari of New York, NY.

intel inside pentium

that whenever possible, you closely examine any monitor you plan to buy.

A QUICK REFRESHER

All the monitors in this story have *noninterlaced* (or *progressive scan*) displays. In these displays, each image is scanned onto the front of the monitor's cathode ray tube (CRT) in a single pass by three electron guns that sweep across the screen line by line in horizontal strokes. In standard television sets or *interlaced* monitors, a complete image requires two scans. This is acceptable when you're sitting several feet from the screen and looking primarily at large moving images. But we sit much closer to computer monitors than we do to televisions, and most of what we look at are detailed, static images like word processing text and spreadsheets. For this reason, most computer users should not consider anything but a noninterlaced display.

The image characteristics of what you see on a monitor partly depend on what kind of cathode ray tube (CRT) the monitor uses. The most common type is the *flat square tube (FST)*, which has a slightly curved facade that dips backward in all four corners as if it were the sliced-off section of a basketball. FSTs minimize curvature, but the curvature is still visible.

The other popular tube type is the *vertically flat CRT*. The screens of these models curve backward only at the sides, like a sliced-off section of a paper towel roll. For many years, Sony's Trinitron tube was the only vertically flat CRT, but now Mitsubishi sells its own DiamondTron tubes based on similar technology. Of the 43 monitors we tested, 5 use Trinitron tubes and 2 use DiamondTrons. The rest use flat square tubes.

Many buyers prefer the look of vertically flat screens, which tend to have bright, saturated colors and outstanding image uniformity. But at higher resolutions they do have one drawback: two horizontal hairlines that cut across the screen and divide the image into thirds.

The two lines are caused by thin dampening wires strung across the back of the screen. Standard FSTs have a metal plate with tiny round holes punched in it called a *shadow mask*. In each hole are colored phosphors that the electron beams light up to create the on-screen image. Trinitron and DiamondTron tubes use an *aperture grille*, which is composed of thin vertical strips with rectangular rather than round holes. This construction makes vertically flat CRTs more susceptible to shock and the heat created by the electron guns. The dampening wires are used to prevent the aperture grille from getting bent out of shape as it gets hotter. If you think you might be distracted by these hairlines in AutoCAD files or other similarly detailed images, make sure you see the monitor with your own eyes before you buy.

And if you think the "17-inch" label is misleading (since you typically get an image of less than 16 inches diagonally), you're not alone. Several state attorneys are considering forcing monitor vendors to put a measurement of the actual viewable area on packaging and literature along with the "17-inch" designation.

DIFFERENT PRICES FOR DIFFERENT USERS

The 17-inch monitors in this roundup fall into three general categories: those with

HIGHLIGHTS

17-Inch Monitors

Sales of 17-inch monitors continue to grow. Despite a rebound in prices due to component shortages and other factors, 17-inch units could account for 25 percent of the monitors shipped next year (versus 15 percent last year).

THE ADVANTAGES of a 17-inch display become clear once you've experienced the bigger picture. The extra display size lets you have more application windows open and visible, so you can quickly toggle from app to app. You can also see more of a large spreadsheet, desktop publishing page, or graphic image with less scrolling. And when work is done, Descent is much more fun big in your face.

A THREE-TIERED MARKET is emerging, and monitor makers have been releasing products targeted toward each segment. At the low end are the cost-conscious buyers looking to upgrade to a larger display, often for home use. Monitors in this tier typically sell for less than $750 but exact some penalties in features and image quality. The middle market ($750 to $900) is primarily business buyers. Since the monitors will be used many hours each day, better screen images and more comfortable ergonomics are as important as price. Graphics professionals and CAD/CAM users require near-flawless display quality, as well as the ability to control almost every attribute of the image. Prices here reach $1,000 or more.

STARING AT A MONITOR at close range for 8 or more hours a day makes comfort a concern. Check the vertical scanning refresh rate in the resolution you plan to use. A rate of at least 72 Hz is comfortable; a rate of 60 Hz means noticeable flicker that can cause eyestrain. All of the monitors in this review meet the MPR II standards for ELF and VLF emissions, and some meet the stricter TCO standard.

MORE AND MORE MONITORS are offering extra conveniences. So-called multimedia monitors offer built-in speakers and audio connectors. Plug and Play capabilities are also becoming prevalent, which should make syncing up your monitor and graphics adapter under Windows 95 easier.

MONITOR TESTING is part science, part art. The equipment used can often detect flaws that are not noticeable to the human eye. So in addition to our labs-based tests, we had our reviewers go through a checklist of subjective evaluations of the screen image to determine if any measured flaws were noticeable. Pay as much attention to these descriptions of display quality as you do to the objective test results.

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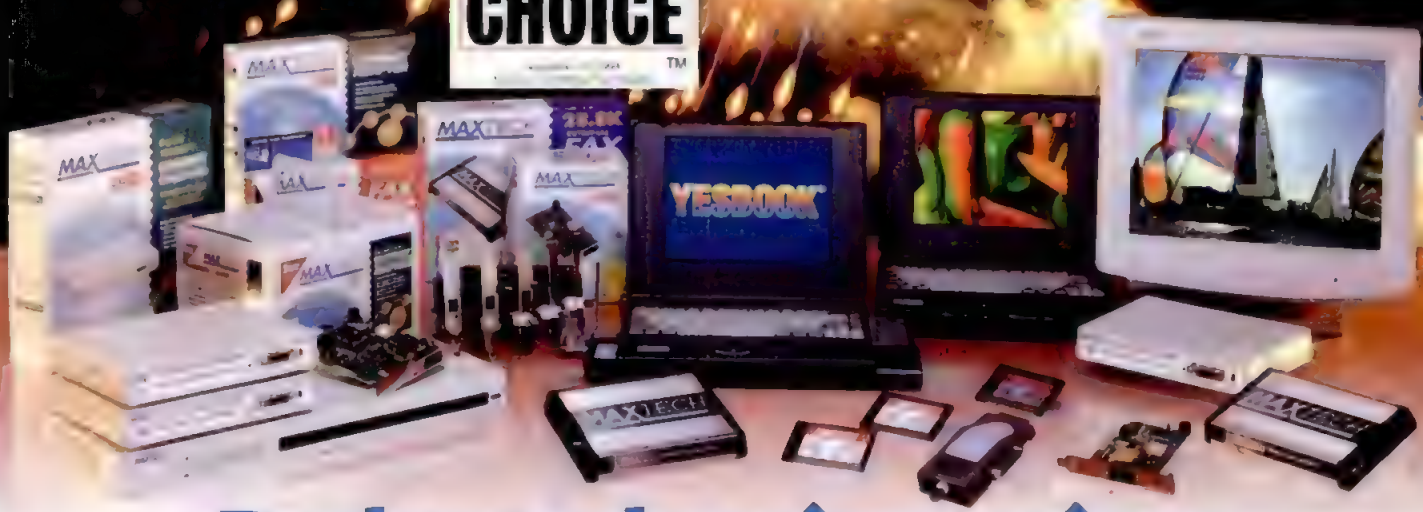

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street prices below $750 aimed at home PC users or users on limited budgets, those priced between $750 and $900 for business users who need more features, and those costing more than $900 for uncompromising desktop publishers, designers, and engineers.

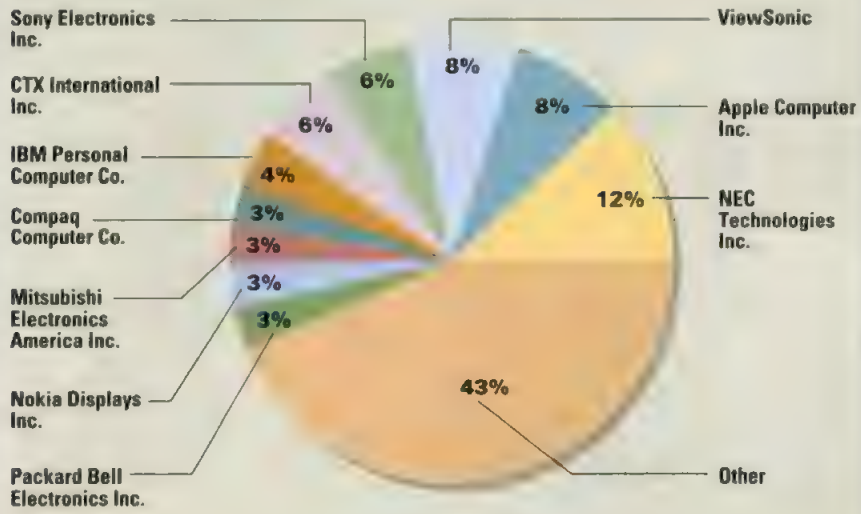
One feature that distinguishes some lesser-priced models from the high-end displays is *dot pitch*. In standard FST monitors, dot pitch refers to the diagonal distance in millimeters between two phosphor dots of the same color. (In Trinitron- and DiamondTron-based monitors, the distance is measured horizontally.) For graphics-intensive work at resolutions above 1,024-by-768, a 0.25-mm or 0.26-mm dot pitch is preferable. Business and home users will find that a dot pitch of 0.27 mm or 0.28 mm suffices for most applications running in 1,024-by-768 mode or lower. The odd man out in terms of dot pitch in this roundup is Orchestra's Tympani, which has the lowest price but also the largest dot pitch (0.42 mm).

Another main feature that divides 17-inch monitors into different classes is the display's available resolutions. Typical low-end models will comfortably meet the 1,024-by-768-pixel requirement with a vertical refresh rate of 75 Hz. But when the resolution is raised on such models to the sharper 1,280-by-1,024 mode, the vertical refresh rate may fall to 60 Hz. This can create noticeable image flicker. Consequently, at least one monitor maker (NEC) provides a "recommended resolution" rating and a maximum resolution rating.

Most business users will find that anything higher than 1,024-by-768 on a 17-inch display results in text and icons so small they make you squint. If you want a better resolution to work in high-end graphics or CAD applications, however, make sure it's available with an eye-saving vertical refresh rate of 72 Hz or higher. Two of the best units in this regard are the Nanao FlexScan F2 17EX and FlexScan F2 17TS, which can handle 82 Hz in 1,280-by-1,024 mode.

17-Inch Color-Monitor Market

This chart shows U.S. market share for 1994, by unit sales, for the top ten manufacturers of 17-inch color monitors. Roughly 13 percent of all color monitors shipped in the U.S. last year were 17-inch units (1.7 million out of 12.9 million).



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CONTROL FREAKS

Most manufacturers now offer full digital controls and pop-up on-screen menus to help you navigate through brightness, contrast, size, and position adjustments. Although they may sound like minor features, such controls make a world of difference when it comes to getting the best picture possible on your desktop. The easier the controls are to use, the more likely you are to correct any small aberrations.

The more expensive monitors in this roundup offer more control than ever. The Mitsubishi Diamond Pro 17TX, for example, allows you to adjust convergence on different parts of the screen as well as correct trapezoidal distortion, moiré patterns, orthogonality, and parallelism. Still, some monitors, such as the Sony Multiscan 17sf and the Radius Precision View 17, still lack on-screen help. The Sony, the Radius, and Orchestra's Tympani fail to include a degaussing button, which allows you to disperse electromagnetic buildup on the screen without powering down the monitor.

Others, such as the NEC models and the Nokia Multigraph 447X, distinguish themselves with particularly astute designs. The on-screen menus on NEC's models use plain English terms to describe image adjustments and use animated icons to demonstrate what aspect of the picture you're about to adjust. The Nokia Multigraph uses just two buttons to set up its extensive adjustments.

This fall, users will be able to exert even more control over new monitors. With the long-awaited introduction of Microsoft's new operating system, Windows 95, comes a wave of new monitor standards. In an attempt to match a monitor's capabilities with those of an attached graphics adapter, Windows 95 will support a Plug and Play standard for monitors. But you may see manufacturers quoting several different acronyms to designate Plug and Play compatibility.

The first is *DDC1*, for *Display Data Channel 1*. Monitors that are DDC1-compliant use one of the pins on a standard VGA cable to send basic information (the monitor's model, make, frequency range, and preset resolutions, for example) to the graphics adapter. The communication is one-way, and the graphics adapter must be DDC1-compatible as well, but this simple method should prevent your PC from ever booting up in a resolution your monitor can't handle.

The basic DDC1 specification was later expanded to include two-way communication between the monitor and graphics adapter using two pins on a standard VGA cable. This specification is called *DDC2B*, and it has the added benefits of being much faster than the DDC1 specification and of allowing the operating system to query the monitor (via the graphics adapter) and find out what its features are. To be *Windows 95*

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Plug and Play–compatible, a monitor must be both DDC1- and DDC2B-compatible. If you have a compatible graphics adapter, you will be able to switch resolutions on the fly without rebooting. In this roundup, 18 monitors are Plug and Play–compatible.

Taking control one step further, some monitor makers are considering adopting new standards for two-way communication and connectivity with other devices. The main contenders are the ACCESS.bus, jointly developed by DEC and Philips, and the Universal Serial Bus (USB), a recently announced spec created by a committee that includes Compaq, IBM, Intel, Microsoft, and NEC. The USB spec should be officially released in the fall of 1995.

ACCESS.bus (also referred to as the DDC2AB standard) is offered in only one monitor we tested—the NEC MultiSync XP17. An ACCESS.bus plug looks like an RJ-11 jack; when used with compatible peripherals, like mice and keyboards, it enables you to daisy-chain a series of components together (up to 128) in any order you like and plug them all into the computer with a single jack. And because ACCESS.bus peripherals convey their information directly to the system, software drivers, jumpers, and DIP switches can be phased out and you can plug and unplug components without restarting your PC.

On monitors, ACCESS.bus provides the same information and bidirectional communication between the system and display as DDC2B does. In addition, it allows you to store monitor settings on your hard disk for recall at any time. ACCESS.bus's standard command structure also lets you adjust the screen's image using a mouse or keyboard, so you can see what you're doing without leaning forward to push buttons. Furthermore, it lets you plug standardized color-calibration hardware directly into the monitor. NEC offers the $399 ColorProof calibrator with software for its ACCESS.bus-compatible monitors.

Able to handle up to 65 peripherals, the

Orchestra's Ensemble: One Sour Note, One Newcomer

By Steve Buehler

Orchestra MultiSystems has two new 17-inch offerings that didn't quite fit into our main roundup. The Tuba II ($699 list and street), aimed at business and home users, is clearly one of the better performers in the low-priced monitor arena; shipping models just missed our review deadline. The Tympani ($469) is aimed squarely at the budget-conscious buyer; however, its 0.42-mm dot-pitch screen and ability to deliver 1,024-by-768 resolution at only 60 Hz failed to meet our filter requirements. But since its street price rivaled that of many 15-inch monitors, we wanted to see what it had to offer.

The Tuba II has a large 16.2-inch viewing area and a good 0.26-mm dot pitch. It achieved generally better-than-average results on both our labs-based and subjective tests. Text was clear down to small point sizes and color images reproduced well. Average MTF scores and better-than-average pincushioning test results showed good geometric linearity. The monitor had subpar spatial uniformity, but our one real concern was the contrast: Even at its best, the white was not as bright and the black not as dark as on most other monitors.

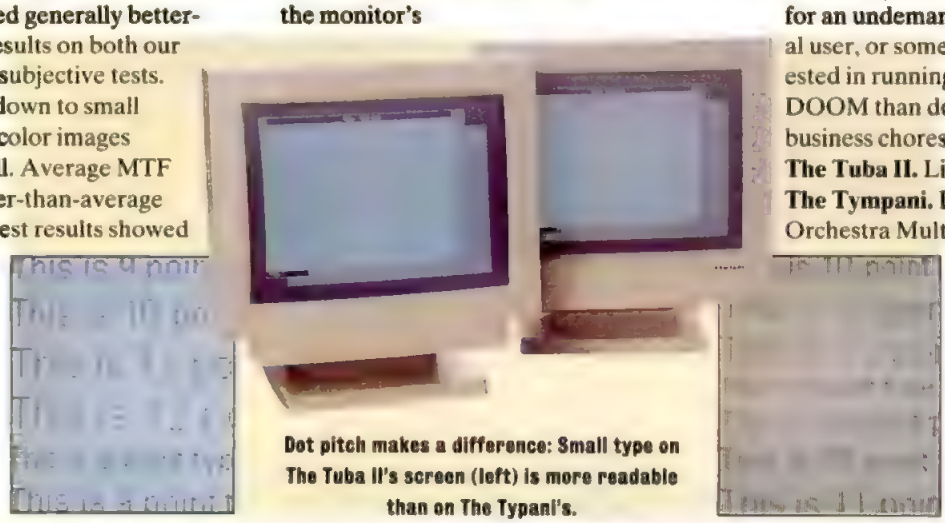
Still, with good picture quality and such extras as on-screen adjustments for tilt, pincushioning, barrel and trapezoid distortion, and color balance, the Tuba II is a solid performer for business users who are looking for more on-screen real estate.

The Tympani's aggressive pricing results in rock-bottom features and performance. While most 17-inch monitors have a shadow mask with an 0.25- to 0.28-mm dot pitch, The Tympani uses a screen with a 0.42-mm dot pitch—even larger than that of a television set, which has 0.35 mm.

The large dot pitch contributed to the monitor's overall poor focus in our MTF and subjective tests. Text at small point sizes was nearly unreadable, and line resolution was very poor. The misconvergence score for this monitor was also extremely poor, with straight white lines resolving into three distinct color lines at screen corners. There was moderate pincushioning and some narrowing of the screen in the top and bottom center—almost like an hourglass on its side. While The Tympani is rated up to 1,024-by-768, it can achieve that resolution only at a refresh rate of 60 Hz; to reduce flicker to acceptable levels on our tests, we used 800-by-600 at 72 Hz.

The Tympani's image quality and feature set will probably suffice only for an undemanding or occasional user, or someone more interested in running games like DOOM than doing day-to-day business chores.

The Tuba II. List price: $699.
The Tympani. List price: $469.
Orchestra MultiSystems Inc., *12200 Industry St., Garden Grove, CA 92641; 800-237-9988, 714-389-3861; fax, 714-891-2661.*
Circle 468 on reader service card



Dot pitch makes a difference: Small type on The Tuba II's screen (left) is more readable than on The Tympani's.

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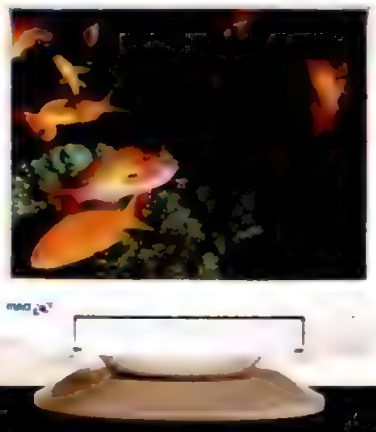

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MAG INNOVISION

Universal Serial Bus should offer much of the functionality of the ACCESS.bus—but at a much higher speed. USB is designed to handle up to 12Mb of data per second (versus 400Kb per second for the latest ACCESS.bus specification), which makes it acceptable for telephony and digital video. With its faster transmission speed and backing from Intel and Microsoft, USB is expected to win out over ACCESS.bus eventually; indeed, few vendors have jumped on the ACCESS.bus bandwagon.

In the meantime, some models we tested offer proprietary solutions. The Mitsubishi Diamond Pro 17TX includes a RS232 serial-control interface that allows you to change the monitor's settings via the keyboard or mouse. Several of Nanao's monitors also offer a serial interface for adjustment software.

MULTIMEDIA

Today's multimedia PCs can create a tangle of cables, speakers, and microphones on desktops. Several monitors try to clear up this mess. These so-called multimedia monitors, including the IBM 17S/S, the Nokia Valuegraph 447L, the Panasonic PanaMedia 17, the Philips 17B, and the ViewSonic 17GA, conceal stereo speakers and a microphone within their chassis.

Technically, speakers and monitors are mortal enemies. Monitors are highly susceptible to magnetic interference, and magnets are the main components of speakers. So marrying these rivals in the same box is a tricky business. To overcome potential conflict, most of the multimedia monitors provide only a small amount of amplification to the speakers—2.5 watts of power per channel or less. Furthermore, the speakers are relatively small compared with external desktop models.

Nevertheless, for users of business apps who are confined to small cubicles, multimedia monitors offer a convenient space-saving solution. Most notably, the IBM unit incorporates a built-in compartment for a video camera for videoconferencing, thus further reducing cable clutter.

On top of the new features, the latest 17-inch monitors continue to improve on existing capabilities. Color adjustments, now available on most monitors, allow you to adjust the intensity of the red, blue, and green guns. Many monitors come bundled with color-matching software that helps match on-screen colors to the output of a color printer. Sonnetech's Colorific color-management software, offered standard or as an option with 14 monitors reviewed here, is the best we saw in this category.

For more convenient color correction, several monitors with serial ports include color-adjustment software that you can control with a mouse. MAG InnoVision, for example, offers a $39.95 software utility and serial cable you can use to set its monitor's image. And hardware solutions provide even more precise and automated adjustment for, say, conducting DTP work in suboptimal lighting conditions. Nanao offers a $275 color-calibration system called FlexColor that is similar to NEC's ColorProof system.

POWER AND EMISSIONS

Power management has become a standard feature of 17-inch displays. All the monitors in this review meet the EPA's *Energy Star* guidelines for reduced power consumption during idle times (less than 30 watts). All use VESA's *Display Power Management Signaling* (DPMS) standard to communicate with a compatible graphics adapter to achieve the power savings. But even if you have an older PC, you can get some power-down benefits by purchasing a monitor that uses *screen blanking*. Screen blanking works by recognizing when a screen saver has come on and then automatically dimming the screen and powering down.

Despite conflicting scientific reports about the potential health hazards of ELF and VLF monitor emissions, most monitor makers continue to work to reduce emissions. The basic standard is the 1990 MPR II specification, though the 1992 TCO standard has become more prevalent in Europe. TCO lays out tougher restrictions on monitors, measuring emissions from 30 cm in front of the screen, for example, versus MPR II's 50-cm measurement. TCO also includes the European NUTEK power-down specification.

TCO is gradually gaining acceptance in the U.S. as well. Last year, only three of the 17-inch monitors we evaluated offered TCO compliance as an option. This year, nine monitors come standard with TCO certification and six offer it as an option.

Most monitors come with a standard 15-pin VGA connector to hook up to your PC. But if you're using a professional graphics adapter on your current computer, check its connections. You may require a coaxial BNC input, which is available as standard on more expensive models and as an option on lesser-priced displays. If you commonly switch between two systems, look for a model with multiple connections.

Those working in cramped quarters or from a home office should also look for monitors housed in smaller chassis. Some 17-inch monitors can be as deep as 20 inches; more svelte displays, like the Mitsubishi Diamond Pro, require only 16.8 inches of desktop depth.

Shopping for a monitor is not an easy task. We suggest that after reading the reviews, you select a few units that fall within your budget plans and go out and look at the models in local stores. There's nothing like judging something with your own eyes.

Compaq 171FS: Barely passable.

Compaq Computer Corp.

Compaq 171FS

BY KATIE BARNES

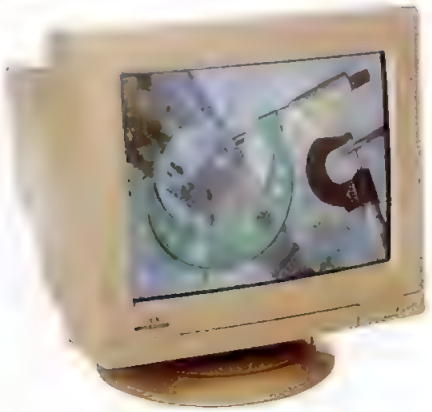
On paper, the Compaq 171FS ($899 street) has plenty of features to entice business users: DDC2B Plug and Play compatibility, advanced digital controls such as color matching, and a three-year warranty (with on-site service for the first year). But given its barely passable performance and small maximum viewable area, you'll find better value elsewhere.

In our subjective evaluations, the Compaq's 0.28-mm dot pitch gave it a grainy texture that caused text to appear blurred and slightly muddy. Indeed, the 171FS scored well below the average on

our MTF test, a measure of picture sharpness, and is not ideal for writing-intensive chores. Color quality was also not a strength. Although the monitor showed acceptable color-tracking ability on our lab tests, colors looked dull. Spatial uniformity was among the worst we saw, and the evident pincushioning error could not be eliminated. In its favor, the monitor exhibited little misconvergence.

The controls could stand a lot of improvement. No on-screen control utility is provided, and the series of button presses you must perform is not intuitive: You must first press a function button and then quickly push the position buttons to toggle through the various modes. You figure out which attribute you're controlling by the number of times the power LED blinks. **Compaq 171FS.** *Estimated street price: $899. Compaq Computer Corp., P.O. Box 692000, M120208, Houston, TX 77269-2000; 800-345-1518; fax, 713-378-1442.*

Circle 441 on reader service card



CTX 1785GMe: A very good value.

CTX International Inc.

CTX 1765GMe
CTX 1785GMe

BY GORDON MCCOMB

PC MAGAZINE EDITORS' CHOICE

The CTX 1765GMe ($929 list, but a low $649 on the street) and CTX 1785GMe ($999 list, $699 street) are aimed squarely at the home and mainstream business markets, and their features and performance make each monitor a very good value. The extra money you'll spend for the 1785GMe gets you a smaller dot pitch (0.26 mm versus 0.28 mm) and better resolutions (1,280-by-1,024 at 75 Hz versus 1,024-by-768 at 75 Hz). If you don't need the higher resolution, though, we recommend the less-expensive 1765GMe.

In subjective evaluations, the 1765GMe's sharpness was better than average, with a crystal-clear screen image and legible type even at 6 points. Some convergence problems were evident in the corners, but nothing was terribly noticeable. The unit doesn't provide on-screen menus for its digital controls, but you can adjust color temperature, trapezoidal alignment, pincushioning, and tilt via the intuitive front-panel buttons.

Though the 1785GMe is the more-expensive monitor, it actually was less impressive than its sibling on several subjective tests. For example, the 1785GMe unit we evaluated exhibited a shimmering, rope-like distortion pattern at the top of the screen that could not be corrected and was not seen in the 1765GMe. And despite its smaller dot pitch, the 1785GMe suffered from lower sharpness in the corners on our subjective focus tests (though the picture was still acceptably sharp).

The 1785GMe did outperform the 1765GMe (and most of the other monitors we tested) in color tracking and showed less pincushioning. As with the 1765GMe, though, misconvergence was evident in the corners of the screen. Here again, resolution can be pushed to 1,600-by-1,280, but the refresh rate drops to 60 Hz.

Both have a three-year warranty (two years on the CRT). You'll do well with either one, but if you don't need the higher resolution, save a couple of dollars and opt for the good-looking 1765GMe.

CTX 1765GMe. *List price: $929.* **CTX 1785GMe.** *List price: $999. CTX International Inc., 20530 Earlgate St., Walnut, CA 91789; 800-888-2012, 909-595-6146; fax, 909-595-6293.*

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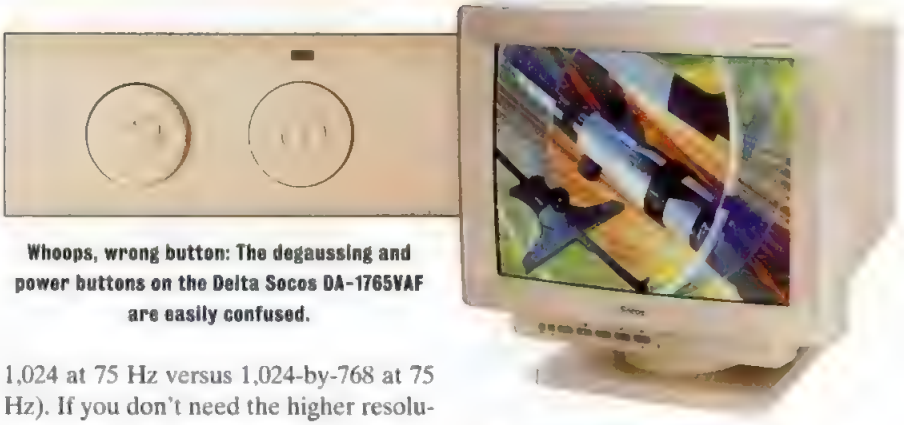

Whoops, wrong button: The degaussing and power buttons on the Delta Socos DA-1765VAF are easily confused.

Delta Products Corp.

Socos DA-1765VAF

BY GORDON MCCOMB

The $665 street price ($765 list) of the Socos DA-1765VAF clearly marks it as a low-end monitor for the budget-conscious office or home user. But this unit delivers more than most bare-bones 17-inch monitors, including a respectable 0.26-mm dot pitch. Picture quality, though flawed, is still acceptable for this class and should prove fine for light-duty business applications and game and edutainment uses.

Of course, there are little quirks. For example, the ergonomics of the unit could be improved. We found it hard to tilt the monitor forward and back on its stand, and the degaussing button is located next to the power button and is the same size; more than once we pressed the wrong button. On a more positive note, front-panel adjustments are provided for color, pincushioning, trapezoidal alignment, and tilt.

Overall image quality isn't bad. The picture could have been sharper (on our labs-based tests it scored next-to-last for MTF), but the monitor should be suitable for less-demanding chores. The Delta showed no convergence problems, though close visual inspection of the screen revealed a serpentine artifact along the entire left edge, which may have caused the poor MTF and pincushioning results.

If low cost is your aim, the Delta is a valid contender, but picture quality is somewhat of a compromise. You'll need to decide if its strengths match your needs. **Socos DA-1765VAF.** *List price: $765. Delta Products Corp., 3225 Laurel View Ct., Fremont, CA 94538; 510-770-0660; fax, 510-770-0122.*

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[1]3 years - parts; 1 year - labor.

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Performance Tests: 17-Inch Monitors

It would be almost impossible for a single monitor to achieve excellent results on all of our tests. Nevertheless, our testing did reveal several standouts—as well as a few 17-inch monitors you might want to avoid.

What the Numbers Mean

A monitor's screen image is actually the result of a delicate balancing act: Achieving the best possible focus, for example, may require sacrificing some brightness. As a result, each monitor has its own look. When deciding what monitor to buy, you should certainly scan the results of the objective tests shown here, but make sure you check the reviews for subjective evaluations. Objective test scores may appear to indicate a problem that in fact is not bothersome to the eye because of an outstanding combination of other attributes. At the same time, problems that are visible in subjective testing may not show up in objective tests.

For each objective test, we present ranges that represent excellent performance, acceptable performance, and unacceptable performance. These ranges are based upon a combination of accepted industry norms and our own observations regarding the subjective perceptibility of flaws. A rating of *excellent* indicates that the error is not visible to the unaided eye and was hardly detectable with our test equipment; *acceptable* means the error would probably be apparent if you looked for it but is not annoying; and *unacceptable* denotes that flaws are noticeable and may hinder you in some types of chores.

Though there was no one clear winner, five monitors—the Hyundai DeluxScan 17, the Nanao FlexScan F2•17 and FlexScan T2•17, the Samsung SyncMaster 17GLsi, and the Samtron SC-726DXL—garnered the best overall test results. Each of these monitors performed ahead of the pack on most of the tests.

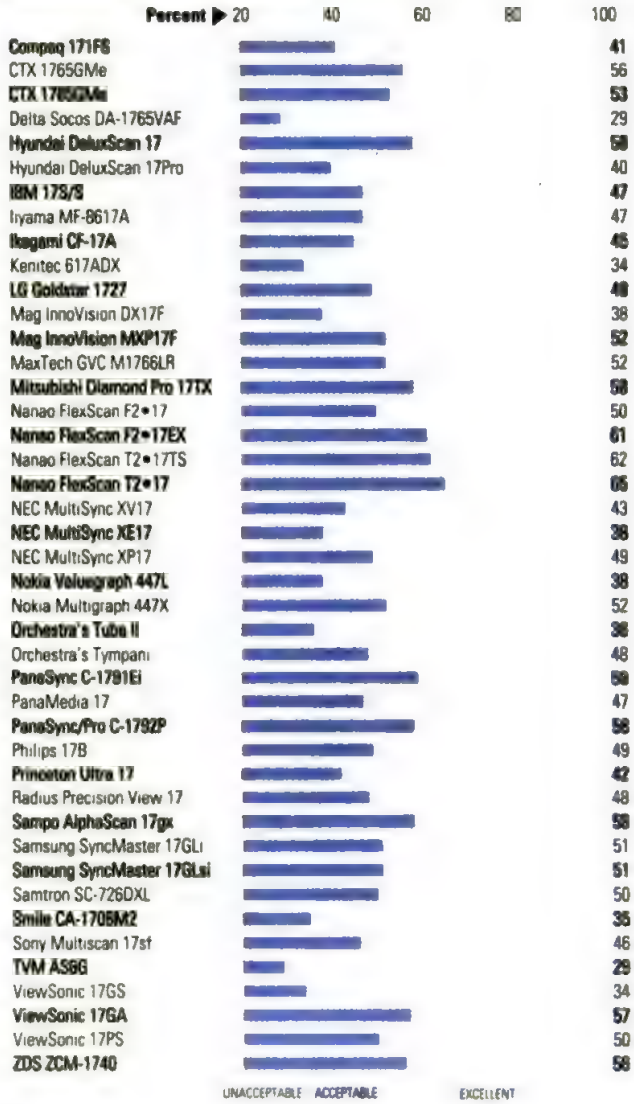
The Ikegami CF-17A, Kenitec 617ADX, Orchestra Tympani (reviewed in the sidebar "Orchestra's Ensemble"), and TVM AS6G found themselves near the bottom on the majority of our tests. Though we would not necessarily rule them out for some less-demanding applications (such as games and light home or office use), anyone working long hours at a monitor may want to opt for a better performer.

How We Tested

For all the objective tests, ZD Labs used a Northgate Slimline SP 433 with 8MB of RAM running MS-DOS 6.2 and an ATI Graphics Ultra Pro Turbo graphics card with 4MB of VRAM. The graphics card was set for 1,024-by-768 resolution and a 76-Hz vertical refresh rate. We also used a MicroVision SpotSeeker III to measure modulation transfer function, misconvergence, and pincushioning. We used a Minolta CRT Color Analyzer CA-100 to measure color tracking and spatial uniformity. All monitors were allowed to warm for at least 30 minutes but not more than 45 minutes prior to testing and were examined on a Newport Optical Table to isolate the SpotSeeker from external vibration. VESA's Display Specifications and Test Procedure Version 1.0 Revision 1.0 was used as the basis for some of our tests.

AVERAGE MTF

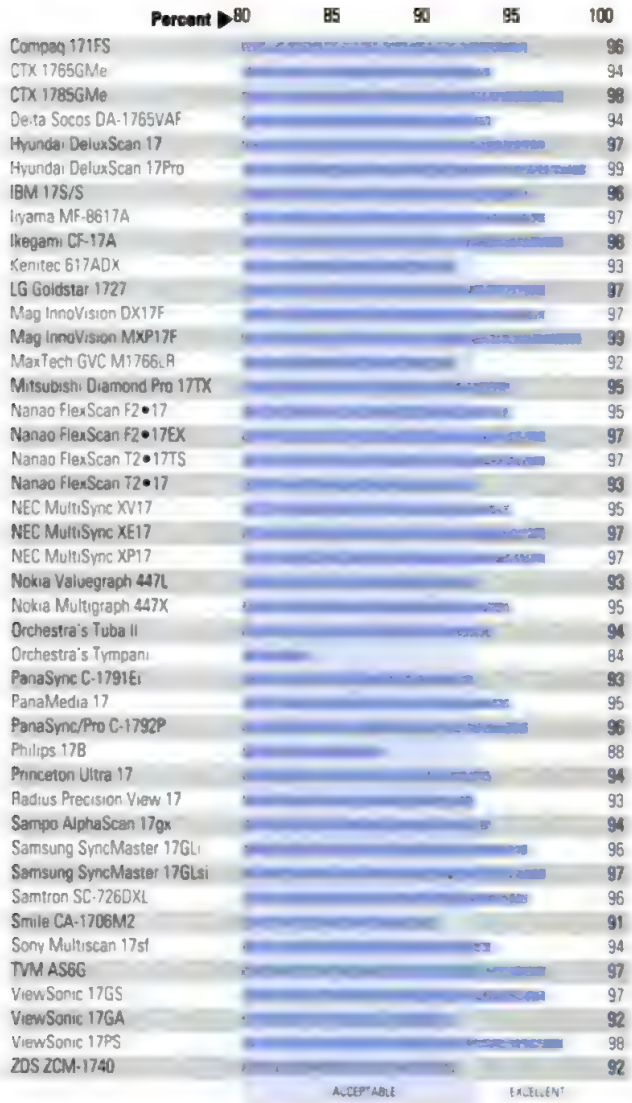
TEST DESCRIPTION The Average MTF (modulation transfer function) can be loosely defined as the ratio of contrast to maximum usable brightness, and serves as an indicator of the monitor's sharpness. We set each monitor to display a pattern of alternating black lines and white lines, each one pixel wide, in both the vertical and horizontal planes. We adjust the contrast and brightness levels to achieve the largest possible MTF and record the result. We then report the average of the horizontal and vertical test results.



DISCUSSION A higher score reflects a better ability to represent fine detail, most noticeable in the crisp display of text. A score above 50 percent is excellent; a monitor that scored below 35 percent is not recommended for intensive writing work. Nearly half of the monitors tested had excellent MTF scores, with three of the four Nanaos we tested leading the field. Nineteen monitors scored acceptably (above 35 percent) on our test. Five monitors scored poorly, below our threshold of 35 percent. Two units, the Delta Products DA-1765V and the TVM AS 6G, had particularly poor showings on this measure.

COLOR TRACKING

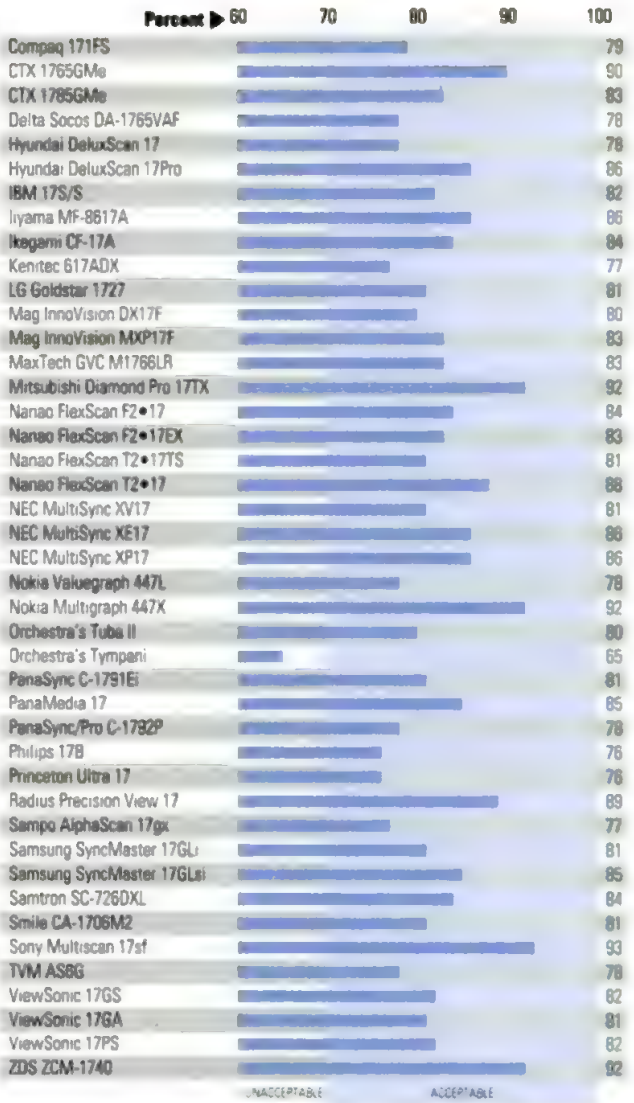
TEST DESCRIPTION Color tracking is a measure of how well the strength of the monitor's three electron guns can remain equal for different shades of gray. To produce a uniform gray, all three colors (red, green, and blue) are used. We measure the intensity of each of the three colors as a percentage of their maximum intensity for each of 16 shades of gray. The percentages were measured with the electron beams varying from 100 percent down to zero percent of their maximum strengths.



DISCUSSION A higher score indicates greater balance among the three electron guns. All the units we tested earned acceptable Color Tracking scores (above 80 percent). These scores indicate that all of the monitors exhibit good balance among their color guns. The Mag InnoVision MXP17F and the Hyundai DeluxScan 17Pro shared the highest score—99 percent. They were followed closely by the Ikegami CF-17A and the CTX 1785GMe (98 percent).

SPATIAL UNIFORMITY

TEST DESCRIPTION Spatial uniformity is a measure of how the luminance of a monitor screen varies across the display. In accordance with the VESA specification, we measure the luminance of a white raster at each corner of the monitor's screen and at the center. Generally, the corners tend to be the dimmest areas of a monitor, while the center is the brightest. The reported result is the average of the center-to-corner ratios.



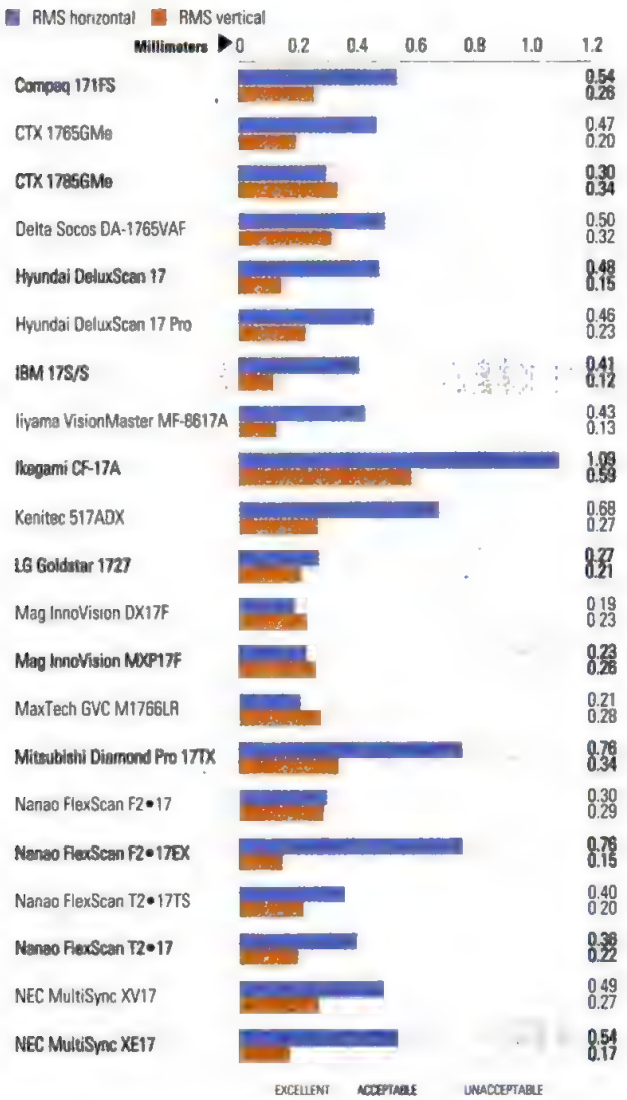
DISCUSSION Higher scores indicate greater uniformity. All of the monitors showed a spatial uniformity of greater than 70 percent except for Orchestra's Tympani (65 percent). This monitor's colors tended toward green and could not be adjusted. The Trinitron-based Sony Multiscan 17sf (93 percent) and the DiamondTron-based Mitsubishi Diamond Pro 17TX (92 percent) scored the highest and showed no hot spots or color shifts.

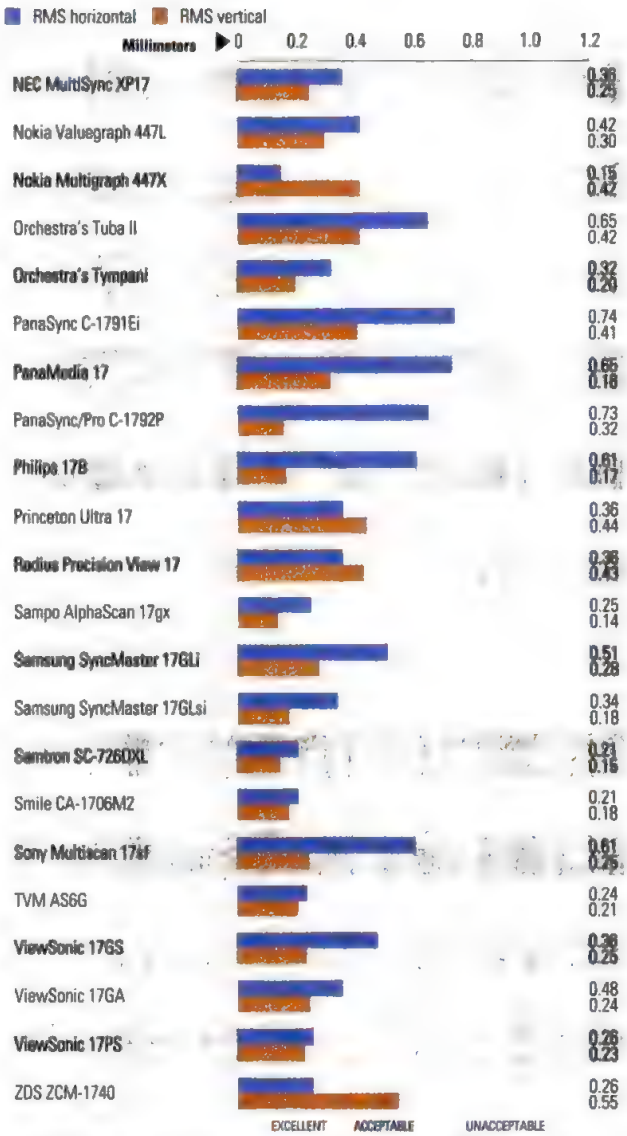
Performance Tests: 17-Inch Monitors

PINCUSHIONING

TEST DESCRIPTION Pincushioning is a measure of how much a straight line curves or bows on-screen. Lines at the edges of the screen tend to exhibit more pincushioning than lines at the center because of the increased deflection of the electron beam. We test each monitor for vertical and horizontal pincushioning with lines placed at the center and edges of the display. We measure the displacement at the very edges of these lines and report the root mean square, or RMS pincushioning, in millimeters for both the horizontal and vertical planes. Pincushion error below 0.4 mm is excellent; displacement above 0.6 mm, however, is noticeable.

Note that many of these monitors allow you to adjust vertical pincushioning. Because we adjust the vertical pincushioning to produce the best picture, results are influenced by the tester's ability to determine a straight line.





DISCUSSION On the RMS horizontal test, 21 monitors scored in the *excellent* range; the Nokia Multigraph 447X led the pack with an imperceivable 0.15 mm. An additional 12 monitors made the *acceptable* range (less than 0.60 mm). But 9 units failed to meet our standard; of these, the most disappointing was the Ikegami CF-17A, which had horizontal pincushioning of a very visible 1.09 mm.

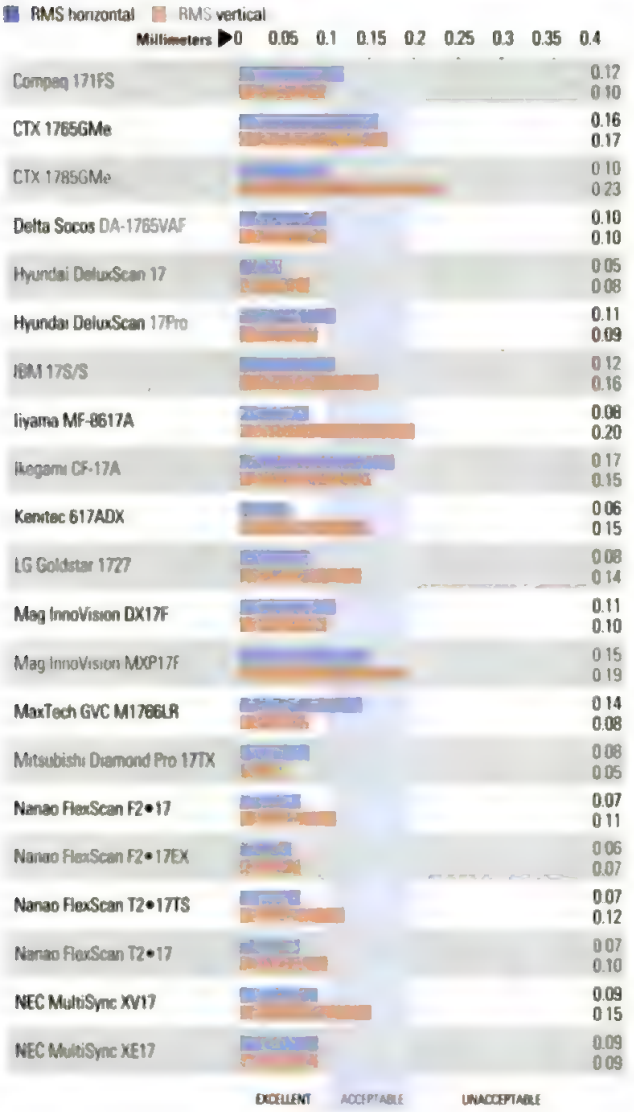
For the RMS vertical test, we first measured pincushion error at the monitor's default value and then adjusted the pincushioning (if possible) to obtain the best image. The IBM 17S/S (0.12 mm) achieved the best score; it was followed closely by the Iiyama VisionMaster 17 Model MF-8617A (0.13 mm) and the Sampo AlphaScan 17gx (0.14 mm). Seven monitors scored acceptably, though the Ikegami CF-17A (0.59 mm) just barely made our cut-off.

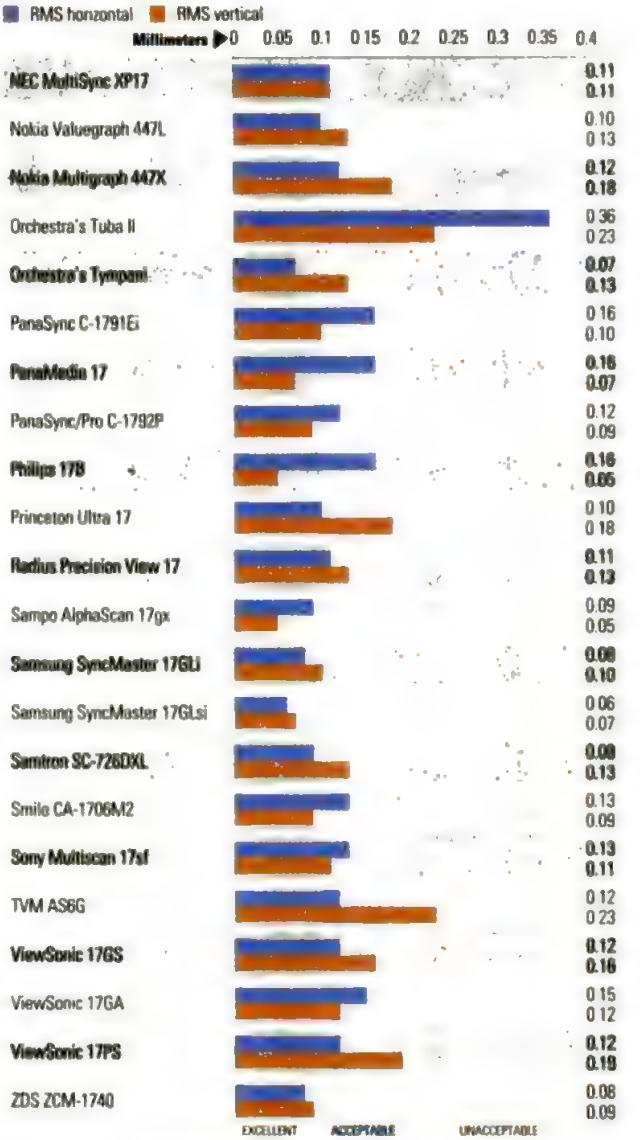
The overall best performers were the Samtron SC-726DXL (0.21 mm horizontal, 0.15 mm vertical) and the Smile CA-1706M2 (0.21 mm horizontal, 0.18 mm vertical). The worst performers were the Ikegami and the Panasonic PanaSync C-1791Ei (0.74 mm horizontal, 0.41 mm vertical).

RMS MISCONVERGENCE

TEST DESCRIPTION A monitor displays color by lighting a combination of red, green, and blue phosphors, typically using a separate electron beam for each phosphor type. When these beams are misaligned, colored halos appear around objects. This phenomenon is called *misconvergence* and is usually most apparent at the corners of the screen, where the electron beams are at their greatest deflection.

For the RMS Misconvergence test, we display two test patterns: five evenly spaced white horizontal lines and five evenly spaced white vertical lines. We measure the beam displacement between red, green, and blue dots within a given line near each corner and at the center of the display. We report the root mean square of the results, or RMS misconvergence, in millimeters in both the horizontal and vertical planes. A score of less than 0.1 mm is excellent; misconvergence greater than 0.2 mm is unacceptable.





DISCUSSION Over the past few years, we've seen misconvergence become less of a problem as 17-inch displays improve. On the RMS horizontal test, all but 1 monitor (Orchestra's Tuba II, at 0.36 mm) fell in the acceptable range; 21 units achieved excellent marks, with scores at or below 0.10 mm. On the RMS vertical test, 3 monitors (the CTX 1785GMe, Orchestra's Tuba II, and the TVM AS6G) fell outside our maximum acceptable score of 0.20 mm. Nineteen monitors scored in the excellent range. The overall best performers were the Nanao FlexScan F2•17EX and the Samsung SyncMaster 17GLsi (0.06 mm RMS horizontal, 0.07 mm RMS vertical).

OTHER TESTS

In addition to the test results presented here, we conducted several other tests that are discussed in the reviews. The Maximum Usable Brightness test measures the screen's brightness at the point before the MTF value begins to drop. We also measured color temperature and contrast ratio (the ratio between the maximum and minimum luminance values) and used test patterns from Sonnera Technologies' DisplayMate for Windows to evaluate screen geometry, distortion, resolution, focus, and text readability.

Hyundai DeluxScan 17: A solid value.

Hyundai Electronics America

DeluxScan 17
DeluxScan 17Pro

By Gordon McComb

Hyundai's DeluxScan 17 ($799 list, $649 street) and DeluxScan 17Pro ($899 list, $749 street) are proof that the more expensive version of a product isn't always better. On both labs-based testing and subjective evaluation, the business-oriented DeluxScan 17 fared excellently—consistently better than the DeluxScan 17Pro.

The DeluxScan 17 is particularly sharp and exhibited very little pincushioning and barrel distortion and only minimal misconvergence in the four corners. Digital pushbuttons and an on-screen menu make it easy to tweak attributes such as pincushioning and trapezoidal adjustment. The monitor enjoyed average or above-average marks on most tests, though spatial uniformity was a weak point. Indeed, the screen did appear a bit blotchy. Still, its picture quality should prove more than suitable for business chores.

The DeluxScan Pro offers higher resolution capabilities and has a better shadow mask (with 0.26-mm dot pitch versus its sibling's 0.28 mm). Additional controls are provided for color matching and tilt, and the DeluxScan Pro has BNC inputs so you can hook up two PCs and toggle between them. By the time you read this, the DeluxScan Pro should be DDC1 Plug and Play–compliant and should feature an on-screen control utility.

On our subjective tests, barrel distortion was noticeable, and the monitor was highly affected by the earth's magnetic field. When we swiveled the monitor on its base, we noticed a rotation of the image of more than 0.25 inches—excessive compared with other monitors in our roundup.

We also noticed screen-regulation problems with the DeluxScan Pro. To test this, we place a thin white border near the outside edges of the screen. Inside this border is a large box whose background flashes between black and white. With most monitors, the test causes a minor displacement of the thin border as the box flashes between black and white. But with the DeluxScan Pro, the background alternated between black and gray. A replacement monitor fared no better. Such a monitor may not be suitable for displaying any image that changes rapidly, like a multimedia movie.

Because of this anomaly, we cannot recommend the DeluxScan 17Pro for multimedia users. But the less expensive DeluxScan 17 is a solid value—one of the best in this roundup.

Hyundai DeluxScan 17. *List price: $799.* **Hyundai DeluxScan 17Pro.** *List price: $899. Hyundai Electronics America, 510 Cottonwood Dr., Milpitas, CA 95035; 800-588-0060.*

Circle 444 on reader service card

IBM Personal Computer Co.

IBM 17S/S

By Brian Fikes

The IBM 17S/S ($1,410 list, $1,300 street) targets business multimedia and videoconferencing users. It has a built-in microphone, internal 2.5-watt speakers, headphone and microphone jacks, and a "multimedia cable" that connects to your computer's sound card and camera input. There's even a compartment on top for the video camera. The unit wasn't a standout on our subjective and labs-based tests, which shows that you're paying extra for the multimedia components—not necessarily for a superior monitor. But the extra components, convenient hook-ups, and clean design may make the IBM worth the premium to you.

The IBM has a bright picture and excellent color range. Its focus was very uniform, and even small fonts were legible. It comes with a wide selection of on-screen controls (including pincushioning, trapezoidal, parallelogram, color-temperature, and moiré adjustments) and offers 1,280-by-1,024 resolution at a flicker-free 77 Hz.

Unfortunately, IBM could not provide the proprietary audio cable in time for testing, so we could not judge the quality of the Panasonic speakers. (Just as unfortunately, problems in transit meant we couldn't photograph the unit IBM provided for this review.) IBM does supply one of the best warranties in the monitor business: three years parts and labor and one year on-site labor.

Other monitors in this price range are better suited to high-end graphics work because of their superior picture quality. As we went to press, IBM introduced its P70 model ($1,189 list). This monitor, targeted at high-end graphics and desktop publishing users, employs a Trinitron tube and offers on-screen controls and Plug and Play compatibility. But if you use videoconferencing or other multimedia functions that take advantage of the 17S/S's many built-in features, this monitor could be a good choice.

IBM 17S/S. *List price: $1,410. IBM Personal Computer Co., Route 100, Somers, NY 10589; 800-772-2227; fax, 800-426-4329.*

Circle 445 on reader service card

Iiyama North America Inc.

VisionMaster 17
Model MF-8617A

By Katie Barnes

Iiyama's VisionMaster 17 Model MF-8617A is a solid, general-purpose business monitor at an attractive price ($899 list, $799 street). Its picture quality isn't perfect, but the Iiyama did have excellent uniformity and not much pincushion error. Slight convergence problems and the silica

Iiyama VisionMaster 17: An attractive option.

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The SC-728FXL offers a flat-square screen color display monitor providing a 1280 x 1024 non-interlaced resolution, and a fine .28mm dot pitch. The SC-726GXL's flat-square screen color monitor delivers a non-interlaced resolution of 1600 x 1200, and features a very fine .26mm dot pitch. Which makes either of them the ideal choice for business graphics, desktop publishing, engineering and design applications. And both models come with a limited 3-year warranty.

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SC-208DXL
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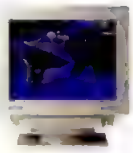
SC-528UXL
15" (13.7V) 0.28 Dot Pitch 1280 x 1024 (60Hz), MPR II



SC-428PTL
14" (13.1V) 0.28 Dot Pitch, 1024 x 768 (60Hz), MPR II, Plug & Play

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CIRCLE 243 ON READER SERVICE CARD

antiglare coating lent a somewhat fuzzy appearance to the screen image, so those who stare at small fonts all day may want to steer clear, but mainstream business users should be satisfied with the display.

The Iiyama had a good showing on our Color Tracking test, though in subjective tests colors tended to look slightly washed out. Resolution capabilities are better than those of most monitors in this class: This unit can run in 1,280-by-1,024 mode at a commendable 80-Hz refresh rate. You can tweak color matching, trapezoidal adjustment, and tilt, and you can choose a color temperature from one of the three stored presets. Instead of an on-screen menu, this unit uses a small LCD panel to display menu items.

VisionMaster 17 Model MF-8617A. *List price: $899. Iiyama North America Inc., 650 Louis Dr., #120, Warminster, PA 18974; 215-957-6543; fax, 215-957-5131.*
Circle 446 on reader service card

Ikegami CF-17A: Plagued.

Ikegami Electronics Inc.

Ikegami CF-17A

BY KATIE BARNES

The Ikegami CF-17A ($899 list) we tested was plagued with performance difficulties. Readily visible linearity and pincushioning problems were confirmed by the Ikegami's bottom-of-the-pack pincushioning scores on our labs-based tests. Add below-average MTF, misconvergence, brightness, contrast, and spatial-uniformity scores and the Ikegami comes out as one of the poorest performers we saw.

Running at its optimal setting of 1,024-by-768 with a 75-Hz refresh rate, the Ikegami couldn't handle complex images, which appeared bent and curved. We also noted regulation problems as the monitor bounced and blinked when changing modes. Focus was fuzzy on the right side of the screen at times, but it was clear enough for displaying simple images and was unaffected by the CRT's fine antiglare treatment. The Ikegami's best mark was its nearly perfect Color Tracking score.

On-screen controls provided plenty of adjustibility and were easy enough to use, but we found the oversize buttons and casing to be unattractive.

As a general-purpose monitor, the Ikegami is outperformed by almost every other unit in this roundup. You should expect more at this price.

Ikegami CF-17A. *List price: $899. Ikegami Electronics Inc., 37 Brook Ave., Maywood, NJ 07607; 201-368-9171; fax, 201-368-1305.*
Circle 447 on reader service card

Kenitec Computer & Technologies Inc.

Kenitec 617ADX

BY SEBASTIAN RUPLEY

At $695 list and only $645 on the street, the Kenitec 617ADX is one of the lowest-priced 17-inch monitors around. Picture quality is merely passable, but the Kenitec may be worth considering for use at home or for less demanding business applications.

The Kenitec is capable of a maximum resolution of 1,280-by-1,024, though at a refresh rate of only 60 Hz; we recommend 1,024-by-768 at 72 Hz. An unexpected plus is the comprehensive on-screen controls—a nice feature for a monitor at this price.

On subjective tests, the Kenitec did well overall; even 4-point text was readable. But there were noticeable flaws: The display was less crisp and bright than others, and we noticed quite a bit of bounce (movement of the display when blinking on and off) during screen-regulation tests. Also, our Spatial Uniformity test showed the right side of the screen to be perceptibly brighter than the left. Pincushion error was unacceptable (the Kenitec was one of the worst on this test) and was noticeable despite the adjustments we made. Still, with its ultralow price tag, the Kenitec 617ADX may be a bargain for those who don't have stringent needs and just want more screen real estate.

Kenitec 617ADX: Passable.

Kenitec 617ADX. *List price: $695. Kenitec Computer & Technologies Inc., 103 Route 17 North, Maywood, NJ 07607; 201-368-2212; fax, 201-909-8735.*
Circle 448 on reader service card

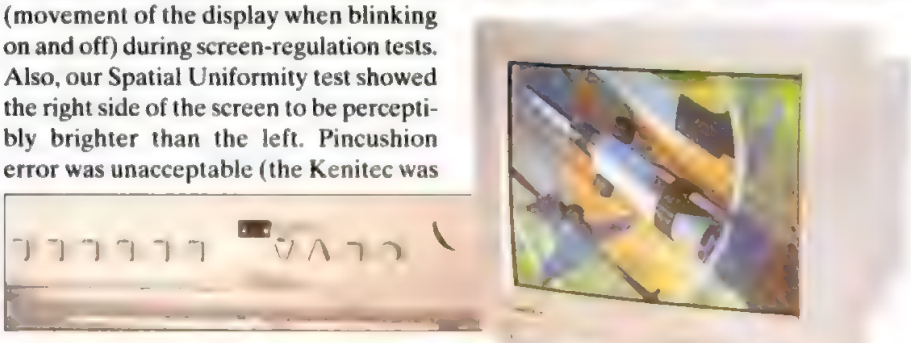
LG Electronics USA Inc.

Goldstar 1727

BY STEVE BUEHLER

Business users seeking a decent performer without a big price tag should consider the Goldstar 1727. Neither its list of features nor its performance stood out from the pack, but at $799.95 (street), the Goldstar is an excellent value.

The Goldstar's above-average MTF score was confirmed by its sharp display; type was very readable, even down to 6 points. The unit also turned in strong misconvergence and adjusted pincushioning scores. We did, however, note slight barreling at the corners as well as banding on the



Inscrutable icons: The LG Goldstar 1727 is excellent, but its control buttons could be better marked.

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flight. Power management was enabled and 8MB RAM was installed. VeriTest, inc. is located in Santa Monica, CA. Promotional pricing is not discountable. *Guarantees available in the U.S. only for registered owners of Dell Latitude systems purchased after 8/8/94. †For a complete copy of our Guarantees or Limited Warranties, please write Dell USA L.P., 2214 W. Braker Lane, Building 3, Austin, TX 78758. ‡Business leasing arranged by Leasing Group, Inc. ★Prices and specifications valid in the U.S. only and subject to change without notice. The Intel Inside logo and Pentium are registered trademarks of Intel Corporation. ©1995 Dell Computer Corporation. All rights reserved.

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Key #21286.

CIRCLE 153 ON READER SERVICE CARD

SUMMARY OF FEATURES

17-Inch Monitors

■ YES ☒ NO

Products listed in review order	Compaq 171FS	CTX 1765GMe (PC MAGAZINE EDITORS' CHOICE)	CTX 1785GMe	Delta Socos DA-1765VAF	Hyundai DeluxScan 17	Hyundai DeluxScan 17Pro	IBM 17S/S	Iiyama VisionMaster 17 Model MF-8617A
List price	N/A*	$929.00	$999 00	$765 00	$799.00	$899.00	$1,410.00	$899.00
Estimated street price	$899 00	$649.00	$699.00	$665.00	$649.00	$749.00	$1,300.00	$799.00
Tube manufacturer	Hitachi	Matsushita	Matsushita	Hitachi	Hitachi	Hitachi	Matsushita	Hitachi
Tube type	Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Flat-square
Dot pitch or aperture (mm)	0.28	0.28	0.26	0 26	0.28	0.26	0.27	0 26
Antiglare treatment	ARAS coating	AGRAS coating	AGRAS coating	ARAS coating	ARAS coating	ARAS coating	AGRAS coating	Silica coating
Active screen size (diagonal, in inches)	14.7	16.0	16.0	16.0	15.7	15.7	15.9	15.8
Dimensions (HWD, in inches)	15.6 x 16.1 x 18.5	17 x 16.5 x 19.1	17 x 16.5 x 19.1	15 6 x 16.5 x 18 8	16.7 x 16 x 18.7	16.5 x 16.1 x 19 8	16.8 x 17.3 x 17.3	16.5 x 16.3 x 19.3
Weight (pounds)	40.4	45 6	46.9	39 9	44.4	45.2	44.2	48.1
Built-in speakers	None	None	None	None	None	None	Matsushita (2.5-watt)	None
Built-in microphone	☒	☒	☒	☒	☒	☒	■	☒
Headphone/external microphone port	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	■ ■	☒ ☒
Type of adapter:								
Captive to 15-pin/15-pin to 15-pin	■ ☒	■ ☒	■ ☒	☒ ■	☒ ■	☒ ■	☒ ■	☒ ■
BNC-3 to 15-pin/BNC-5 to 15-pin	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ■	■ ■	☒ ☒
Macintosh-compatible	☒	■	■	■	■	■	☒	■
Macintosh adapter	☒	■ (on request)	■ (on request)	☒	☒	☒	☒	Optional ($20–$25)
DDC1-compliant/DDC2B-compliant	■ ■	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒
Meets TCO emissions standard	☒	☒	☒	☒	☒	Optional ($75)	☒	☒
Color-matching software	None	None	None	None	None	None	None	Sonnetech's Colorific 1.35 (on request)
Operational Features								
Vertical scanning frequency (Hz)	50–100	50–110	50–110	50–100	50–90	45–100	50–160	50–120
Horizontal scanning frequency (kHz)	30–58	30–65	30–85	30–65	30–64	30–82	30–82	27–86
Bandwidth (MHz)	75	110	135	100	100	135	148	135
Maximum noninterlaced resolution (dots per inch)	1,024 x 768	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,600 x 1,280
Maximum noninterlaced refresh rates (Hz):								
1,600 x 1,200/1,280 x 1,024	N/A**	N/A**, 60	60, 75	N/A**, 60	N/A**, 60	60, 77	N/A**, 77	66, 80
1,024 x 768/800 x 600	75, 75	75, 75	75, 75	72, 72	80, 100	100, 130	77, 85	105, 120
640 x 480	75	75	75	72	125	160	85	120
Claimed power consumption (watts)								
Maximum/standby mode	100, N/A**	120, 96	120, 96	100, 15	100, 80	130, 16	150, N/A**	140, 15
Suspend/off mode	30, 8	15, 5	15, 5	15, 8	28, 8	16, 6	30, 10	7, 3
Controls								
Type of controls	Digital	Digital	Digital	Digital	On-screen	Digital	On-screen	Digital
User can make on-screen adjustments via mouse, keyboard, or both	N/A**	N/A**	N/A**	N/A**	☒	N/A**	☒	N/A**
Color-matching/Pincushioning	■ ■	■ ■	■ ■	■ ■	☒ ■	■ ■	■ ■	■ ■
Trapezoidal adjustment/Orthogonality	■ ☒	■ ☒	■ ☒	■ ☒	■ ☒	■ ☒	■ ■	■ ☒
Tilt or rotation/Convergence	■ ☒	■ ☒	■ ☒	■ ☒	☒ ☒	■ ☒	■ ☒	■ ☒
Thumbwheels for brightness and contrast	☒	■	■	■	☒	☒	☒	☒
Manual degaussing/Degaussing on start-up	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Customer Service								
800 number for technical support	■	■	■	☒	■	■	■	■
Technical-support hours (eastern time)	24 hours, 7 days	5.00–5.00 M–F	5.00–5 00 M–F	12.00 noon–8:30 P.M. M–F	8:00 A.M.–11:00 P.M. M–F	8.00 A.M.–11:00 P.M. M–F	24 hours, 7 days	8.30–5:00 M–F
BBS	■	■	■	☒	☒	☒	■	☒
Warranty (parts and labor, unless specified)	3 years (first year on-site)	3 years (2 years on CRT)	3 years (2 years on CRT)	2 years	2 years	2 years	3 years (first year on-site)	3 years

N/A*—Not applicable: The manufacturer does not quote this kind of price.
N/A**—Not applicable: The monitor does not have this feature.

17-Inch Monitors

Ikegami CF-17A	Kenitec 617ADX	LG Electronics Goldstar 1727	MAG InnoVision DX17F	MAG InnoVision MXP17F	MaxTech GVC M1766LR	Mitsubishi Diamond Pro 17TX	Nanao Flex-Scan F2•17	Nanao Flex-Scan F2•17EX	PC MAGAZINE EDITORS' CHOICE Nanao Flex-Scan T2•17TS
$899.00	$695.00	$949.95	$729.00	$999.00	$749.00	N/A*	N/A*	N/A*	N/A*
N/A*	$645.00	$799.95	$650.00	$950.00	$599.00	$1,199.00	$970.00	$1,098.00	$1,149.00
Hitachi	Matsushita	Hitachi	Hitachi or Toshiba	Hitachi or Toshiba	Hitachi	Mitsubishi	Mitsubishi	Hitachi	Mitsubishi
Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Diamondtron	Flat-square	Flat-square	DiamondTron
0.28	0.28	0.28	0.26	0.26	0.28	0.25	0.28	0.26	0.25
AGRAS coating	AGRAS coating	Silica coating	Etch treatment	ARAS coating	ARAS coating	ARAS coating	AGRAS coating	AGRAS coating	AGRAS coating
15.8	16.0	16.1	16.2	16.2	15.8	16.0	16.0	16.0	16.0
16.5 x 16.5 x 18.8	16.9 x 15.8 x 16.8	17 x 16.6 x 18.7	16.1 x 16.1 x 19.1	16.6 x 17.3 x 19.4	16.1 x 17 x 18.3	15.8 x 16.2 x 16.8	16.2 x 16.1 x 17.5	16.2 x 16.1 x 17.5	16 x 16.3 x 17.5
39.1	41.5	44.2	41.7	52.2	41.5	50.0	43.6	44.5	48.2
None	None	None	None	None	None	None	None	None	None
■	■	■	■	■	■	■	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
■	■	■	Optional ($20)	Optional ($20)	■	■	■ (on request)	■ (on request)	■ (on request)
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	Optional ($99)	■	■	■	■	■
None	None	None	None	None	None	Sonnetech's Colorific 1.35	Sonnetech's Colorific 1.41	Sonnetech's Colorific 1.41	Sonnetech's Colorific 1.41
55–90	50–90	50–120	50–100	50–120	50–90	50–152	55–120	55–160	55–160
24–64	30–66	30–65	30–64	30–82	30–66	30–86	30–69	30–86	30–86
100	100	111	100	130	110	135	75	110	110
1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,600 x 1,280	1,600 x 1,280
N/A**, 60	N/A**, 60	N/A**, 60	N/A**, 60	60, 76	N/A**, 60	68, 75	N/A**, 66	66, 82	66, 82
75, 90	72, 72	76, 90	76, 90	100, 120	80, 100	100, 120	87, 110	110, 140	110, 140
90	72	100	100	120	100	152	120	160	160
140, 15	120, 30	100, 15	120, N/A**	130, N/A**	120, 25	120, 95	90, 10	95, 10	115, 10
15, 5	5, 5	15, 8	15, 10	30, 10	25, 4	30, 8	N/A**, 5	N/A**, 5	N/A**, 5
On-screen	On-screen	On-screen	Digital	Digital (on-screen optional, $39.95)	On-screen	On-screen	On-screen	On-screen	On-screen
■	■	■	N/A**	Optional	■	■	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
9:00–8:00 M–F	9:00–6.00 M–F	9:00–5:00 M–F	8:00–8:00 M–F	8:00–8:00 M–F	8:00–8.00 M–F	11:00–7.30 M–F	8:30–5.00 M–F	8:30–5:00 M–F	8.30–5.00 M–F
■	■	■	■	■	■	■	■	■	■
2 years, 1 year overnight exchange	2 years	2 years (3 years on CRT)	3 years parts (2 years on CRT), 1 year labor	3 years parts (2 years on CRT), 1 year labor	2 years	3 years	3 years	3 years	3 years

SUMMARY OF FEATURES

17-Inch Monitors

■ YES NO

Products listed in review order

	Nanao Flex-Scan T2•17	NEC MultiSync XV17	NEC MultiSync XE17	NEC MultiSync XP17	Nokia Valuegraph 447L	Nokia Multigraph 447X	Orchestra's Tympani	Orchestra's Tuba II
List price	N/A*	N/A*	N/A*	N/A*	$699 00	$1,095 00	$469 00	$699 00
Estimated street price	$1,380 00	$799 00	$1,060 00	$1,099 00	$699 00	$999 00	$469 00	$699 00
Tube manufacturer	Sony	NEC	NEC	NEC	Hitachi	Sony	Philips	Hitachi
Tube type	Trinitron	Flat-square	Flat-square	Flat-square	Flat-square	Trinitron	Flat-square	Flat-square
Dot pitch or aperture (mm)	0 25	0 28	0 28	0 28	0 28	0 25	0 42	0 26
Antiglare treatment	AGRAS coating	None	ARAS coating	ARAS coating	AGRAS coating	AGRAS coating	None	Etch Treatment
Active screen size (diagonal, in inches)	16 0	15 6	15 6	15 6	15 5	15 5	16 1	16 2
Dimensions (HWD, in inches)	16 x 16 3 x 18 6	16 3 x 16 1 x 17 5	16 8 x 16 5 x 18 9	16 4 x 16 5 x 20 5	16 5 x 16 4 x 19 5	16 1 x 17 x 18 5	16 9 x 16 1 x 17 3	16 9 x 16 1 x 17 3
Weight (pounds)	53 8	46 4	48 8	52 3	41 1	45 7	45 0	50 7
Built-in speakers	None	None	None	None	Nokia (2-watt)	None	None	None
Built-in microphone								
Headphone/external microphone port					■			
Type of adapter								
Captive to 15-pin/15-pin to 15-pin	■	■	■	■	■	■	■	■
BNC-3 to 15-pin/BNC 5 to 15-pin	■ ■			■		■		■
Macintosh-compatible	■	■	■	■	■	■	■	■
Macintosh adapter	■ (on request)		■	■	■ (on request)	■	Optional ($29)	Optional ($29)
DDC1-compliant/DDC2B-compliant	■ ■	■ ■	■ ■	■ ■				
Meets TCO emissions standard	■	Optional ($69)	Optional ($69)	Optional ($69)		Optional ($99)		
Color-matching software	Sonnetech's Colorific 1.41 (on request)	Sonnetech's Colorific 2 0 (on request)	Sonnetech's Colorific 2 0 (on request)	Sonnetech's Colorific 2 0	Sonnetech's Colorific 2 0 (on request)	Sonnetech's Colorific 2 0 (on request)	None	None
Operational Features								
Vertical scanning frequency (Hz)	55-160	55-100	55-120	55-160	48-100	50-110	50-90	50-90
Horizontal scanning frequency (kHz)	30-85	31-65	31-65	31-82	30-64	30-82	30-48	30-85
Bandwidth (MHz)	[illegible]	85	85	135	90	140	65	135
Maximum noninterlaced resolution (dots per inch)	1,600 x 1,280	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,024 x 768	1,600 x 1,280
Maximum noninterlaced refresh rates (Hz)								
1,600 x 1,200/1,280 x 1,024	66, 80	N/A**, 60	N/A**, 60	N/A**, 76	N/A**, 60	60, 76	N/A**	75, 75
1,024 x 768/800 x 600	108 138	76, 76	76 76	76, 76	76, 90	90, 110	60 72	75, 75
640 x 480	160	75	75	75	90	110	72	75
Claimed power consumption (watts)								
Maximum/standby mode	140, 15	130, 13	105 11	147, 15	120, 8	140, 8	80, 60	110, 80
Suspend/off mode	N/A**, 8	8, 0	8 0	8, 0	3, 0	3, 0	15, 5	15, 5
Controls								
Type of controls	On-screen	On-screen	On-screen	On-screen	Digital	On-screen	Digital	On-screen
User can make on-screen adjustments via mouse, keyboard, or both		■	■	■	N/A**		N/A**	
Color-matching/Pincushioning	■ ■	■ ■	■ ■	■ ■	■	■	■	■ ■
Trapezoidal adjustment/Orthogonality	■	■	■	■	■	■ ■		■
Tilt or rotation/Convergence	■ ■	■	■	■		■ ■		■
Thumbwheels for brightness and contrast	■	■	■	■				
Manual degaussing/Degaussing on start-up	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■	■ ■
Customer Service								
800 number for technical support	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	8 30–5 00 M-F	8 00–8 00 M-F	8 00–8 00 M–F	8 00–8 00 M–F	9 00–7.00 M–F	9 00–7 00 M–F	12 00 noon–8 00 P M M–F	12 00 noon–8 00 P M M–F
BBS	■	■	■	■				
Warranty (parts and labor, unless specified)	3 years	3 years	3 years	3 years	3 years (2 years on CRT)	3 years (2 years on CRT)	2 years	3 years

N/A*—Not applicable The manufacturer does not quote this kind of price
N/A**—Not applicable The monitor does not have this feature

17-Inch Monitors

Panasonic PanaSync C-1791Ei	Panasonic PanaMedia 17	Panasonic PanaSync/Pro C-1792P	Philips 17B	Princeton Ultra 17	Radius Precision View 17	Sampo AlphaScan 17gx	Samsung SyncMaster 17GLi (PC MAGAZINE EDITORS' CHOICE)	Samsung SyncMaster 17GLsi	Samtron SC-726DXL
$899 00	$999 00	$999 00	$899 00	$689 00	$1,099 00	$799 00	$799 00	$999 00	$950 00
$699 00	$799 00	$849 00	$799.00	$640.00	$949 00	$725 00	$699 00	$949 00	$875 00
Matsushita	Matsushita	Matsushita	Hitachi	Hitachi	Sony	Hitachi	Hitachi	Hitachi	Samsung
Flat-square	Flat-square	Flat-square	Flat-square	Flat-square	Trinitron	Flat-square	Flat-square	Flat-square	Flat-square
0 27	0 27	0 25	0 28	0 28	0 25	0 26	0 28	0 26	0 26
AGRAS coating	AGRAS coating	AGRAS coating	AGRAS coating	Etch treatment	Silica coating	ARAS coating	ARAS coating	ARAS coating	Silica coating
15 7	16 0	15 7	16 2	16 2	16 1	15 8	15 8	15 8	15 8
16 x 16 3 x 17.5	16 3 x 17 2 x 17.3	16 3 x 16.2 x 17 3	16 5 x 16.5 x 17.6	16 1 x 16 1 x 19 1	16 8 x 16 x 17 9	16 x 16 x 19 5	16 5 x 17 x 18	16.5 x 17 x 18	16 8 x 16 5 x 17.5
37 6	40 1	38 4	40 1	41 6	41 6	49 4	39 5	42 8	46 8
None	Matsushita (2-watt)	None	Proprietary (1-watt)	None	None	None	None	None	None
■	■	■	■	■	■	■	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
■ (on request)	■ (on request)	■ (on request)	■	Optional ($20)	■	Optional ($29 95)	■	■	Optional ($7)
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
None	None	None	None	None	None	None	None	None	None
50–160	50–160	50–160	50–130	50–100	50–120	50–120	50–120	50–120	50–120
30–69	30–69	30–82	30–66	30–64	31–64	30–82	30–65	30–85	30–82
86	86	135	110	100	110	135	110	135	135
1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024
N/A**, 64	N/A**, 64	62, 77	N/A**, 60	N/A**, 60	N/A**, 60	65, 76	N/A**, 60	68, 80	N/A**, 76
85, 107	85, 107	101, 128	80, 75	76, 90	75, 75	100, 120	80, 100	105, 120	76, 72
132	132	157	75	100	75	120	120	120	75
100, 30	130, 30	140, 30	110, 85	120, N/A**	130, N/A**	130, 25	100, 80	120, 100	120, 96
30, 8	30, 8	30, 8	15, 5	15, 10	15, 8	25, 8	15, 5	15, 5	30, 8
On-screen	On-screen	On-screen	On-screen	Digital	Digital	Digital	On-screen	On-screen	On-screen
■	■	■	■	N/A**	N/A**	N/A**	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
9 00–5 00 M–F	9 00–5 00 M–F	8 00 A.M.–10 00 P.M. M–F	8 00 A M – 10 00 P M. M–F	8 00–8 00 M–F	10 00–8 00 M–F	8 00–5 00 M–F	9 00–9 00 M–F	9 00–9 00 M–F	11 30–8 30 M–F
■	■	■	■	■	■	■	■	■	■
3 years (first year on-site replacement)	3 years (first year on-site replacement)	3 years (first year on-site replacement)	2 years	3 years parts (2 years on CRT), 1 year labor	1 year overnight replacement	2 years	3 years	3 years	3 years (2 years on CRT)

SUMMARY OF FEATURES

17-Inch Monitors

■ YES ▫ NO

Products listed in review order

	Smile CA-1706M2	Sony Multiscan 17sf	TVM AS6G	ViewSonic 17GS	ViewSonic 17GA	ViewSonic 17PS	ZDS ZCM-1740
List price	$900 00	$999 95	$649 00	$895 00	$995 00	$1 095 00	$999 00
Estimated street price	$775 00	$829 00	$599 00	$795 00	$895 00	$995 00	$899 00
Tube manufacturer	Hitachi	Sony	Hitachi	Matsushita	Matsushita	Matsushita	Sony
Tube type	Flat-square	Trinitron	Flat-square	Flat-square	Flat-square	Flat-square	Trinitron
Dot pitch or aperture (mm)	0 26	0 25	0 28	0 27	0 27	0 25	0 26
Antiglare treatment	ARAS coating	Silica coating	Silica coating	ARAG coating	ARAG coating	ARAG coating	Silica coating
Active screen size (diagonal, in inches)	15 8	16 1	16 0	15 7	16 0	15 7	15 7
Dimensions (HWD, in inches)	15 6 x 16.5 x 17 6	16 5 x 16 x 17 5	16 9 x 16.3 x 19 0	16 4 x 16 1 x 17.1	16 1 x 17 1 x 17 5	16 3 x 16 1 x 17 1	16 5 x 17 6 x 18 1
Weight (pounds)	41 8	41 9	45 0	37 8	40 0	38 3	47 8
Built-in speakers	None	None	None	None	Matsushita (2 8-watt)	None	None
Built-in microphone	[illegible]	[illegible]			■		
Headphone/external microphone port	[illegible]	[illegible]			■ ■		
Type of adapter							
Captive to 15-pin/15-pin to 15-pin	[illegible]	■ [illegible]	■	■	■	■	■
BNC-3 to 15-pin/BNC-5 to 15-pin	[illegible] ■	[illegible]			[illegible]	■	
Macintosh-compatible	■	■	■	■	■	■	■
Macintosh adapter	Optional ($15)	■ (on request)	Optional ($25)	■ (on request)	■ (on request)	■ (on request)	
DDC1-compliant/DDC2B-compliant	[illegible]	[illegible]	[illegible]	■ ■	■ ■	■ ■	
Meets TCO emissions standard	[illegible]	[illegible]		■	■	■	■ (on request)
Color-matching software	None	None	None	Sonnetech's Colorific 2 01 (optional, $19 95)	Sonnetech's Colorific 2 01 (optional, $19 95)	Sonnetech's Colorific 2 01	None
Operational Features							
Vertical scanning frequency (Hz)	50–100	50–120	50–120	50–160	50–160	50–160	50–110
Horizontal scanning frequency (kHz)	30–82	31–64	28–82	30–69	30–69	30–82	31–82
Bandwidth (MHz)	130	110	100	86	86	135	140
Maximum noninterlaced resolution (dots per inch)	1,600 x 1,280	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,600 x 1,280	1,280 x 1,024
Maximum noninterlaced refresh rates (Hz)							
1,800 x 1,200/1,280 x 1,024	60, 75	N/A**, 60	N/A**, 60	N/A**, 65	N/A**, 65	66, 77	N/A**, 75
1,024 x 768/800 x 600	76, 80	76, 90	75, 86	86 108	86, 108	101, 128	75, 85
640 x 480	80	100	86	134	134	152	100
Claimed power consumption (watts)							
Maximum/standby mode	110, 25	130, N/A**	130, 104	110, 90	150, 120	120, 100	180, 170
Suspend/off mode	25, 3	15, 8	15, 5	30, 8	30, 8	30 8	30, N/A**
Controls							
Type of controls	Digital	Digital	Digital	On-screen	On-screen	On-screen	Digital
User can make on-screen adjustments via mouse, keyboard, or both	N/A**	N/A**	N/A**	[illegible]	[illegible]		N/A**
Color-matching/Pincushioning	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Trapezoidal adjustment/Orthogonality	■ ■	■ [illegible]	■ [illegible]	■ [illegible]	■ [illegible]	■ [illegible]	■ [illegible]
Tilt or rotation/Convergence	■ ■	[illegible]	[illegible]	■ [illegible]	■ [illegible]	■ [illegible]	■ ■
Thumbwheels for brightness and contrast	[illegible]	[illegible]	■	[illegible]	[illegible]	[illegible]	[illegible]
Manual degaussing/Degaussing on start-up	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Customer Service							
800 number for technical support	■	■	■	■	■	■	■
Technical-support hours (eastern time)	11:00–8:00 M–F	11:00–8:00 M–Th, 11 00–6:00 Fri	11:00–8:00 M–F	10 00–9 00 M–F	10 00–9 00 M–F	10 00–9 00 M–F	24 hours, 7 days
BBS	[illegible]	■	[illegible]	■	■	■	■
Warranty (parts and labor, unless specified)	2 years	3 years (2 years on CRT)	2 years	3 years parts, 1 year labor	3 years parts, 1 year labor	3 years parts, 1 year labor	First year on-site

N/A*—Not applicable. The manufacturer does not quote this kind of price
N/A**—Not applicable The monitor does not have this feature

Big Sellers.

Bigger Sellers.

CTX monitors— some of the best selling color monitors in the US.*

CTX's new 20-inch, (19"V) monitor — giving you even more for less.

Look what's happened to CTX and our color monitors. We've both grown bigger.

CTX is now a leading supplier of professional multi-frequency color monitors to the U.S., outselling the big names like NEC, Mitsubishi, IBM, Sony and Apple.* We did it by providing more for less.

PC World *Magazine* (April '95) just named our 1785GM monitor as their "**Best Buy**".

In May, 1995, MacUser *Magazine* rated the 1785GM image quality "**Outstanding**". And PC Magazine reported that "CTX (17-inch) monitors have features you might not expect at these prices."

CTX monitors were also recently honored by the EPA for "highest percentage of product line (100%) converted to Energy Star specifications."

Now we're introducing a new 20-inch,(19"V) color monitor. The 2085 has a fine .28mm dot pitch that's ideal for high-resolution, big-screen graphics applications. It comes complete with more front-panel controls than you could ever need. Plus a three-year warranty; PC, Mac and workstation compatibility; MPR-II compliance; and CTX SuperStar™ power-management savings that exceed EPA Energy Star specs by more than 80 percent.

It's time to get bigger and better for less!

CTX

Choice of the Pros.

USA Headquarters 909-595-6146, Eastern Region 201-646-0707, Midwestern Region 708-285-0202, Southern Region 404-729-8909. **FasFax 818-837-4341,026, Document 455.**

©1995 CTX International, Inc. All brand names are trademarks of their respective owners. *Official Stanford Resources Inc. "Monitrak" research,1785GM pictured above. Viewable diagonal for CTX 14,15, 17, & 20-inch monitors are 13, 14, 16 and 19 inches, respectively. *On all monitors, 2 year warranty on CRT. PCM/6/95

CIRCLE 286 ON READER SERVICE CARD

$2,149[1]
HP NetServer LC
- 192MB Max RAM
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- 66MHz Intel 486 processor

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HP NetServer LF
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$5,199[3]-NEW
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- 192MB Max ECC Memory
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- Configuration Assistant
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Complete software toolset to help install and manage servers and the network. Standard feature of HP NetServer LF, LH and LS models

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Complete remote management of server regardless of its status. $995 list. I/O card upgrade for all HP NetServer products

[illegible] as of 5/1/95 [illegible] 66MHz Intel 486 [illegible] 5/1/95 [illegible] 66MHz Pentium processor. [illegible] 5/1/95 [illegible] 75MHz Pentium processor. [illegible] 5/1/95 [illegible] 100MHz Pentium processor. [illegible] Microsoft [illegible] and Windows NT™ and the Windows NT Logo are trademarks of Microsoft Corporation. The Intel Inside and Pentium® Processor logo are registered trademarks of Intel Corporation. UNIX is a registered trademark in the United States and other countries licensed exclusively through X/Open Company Limited. © 1995 Hewlett-Packard Company PHC419

Upon reflection, there's no better way to manage the cost of running your network.
Presenting HP NetServers with the NetServer Navigator on CD-ROM. The cost-effective way to manage your network.
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HEWLETT PACKARD

left side of the display during full-screen single-color tests; this may create problems when you are doing particularly subtle color work. The biggest weakness in the Goldstar's performance was its Maximum Usable Brightness score (not shown in the benchmark test results), which was the second lowest obtained in this roundup.

The Goldstar offers 27 user-defined image and resolution settings, plus a zoom feature, tilt control, and diagnostics. Its new on-screen adjustment controls have a critical flaw, though: The raised icons that mark the tiny buttons for sizing, positioning, and geometric adjustments are difficult to see and interpret.

The Goldstar 1727's respectable performance and competitive price should appeal to business users seeking a quality 17-inch monitor that won't blow the year's budget.

Goldstar 1727. *List price: $949.95. LG Electronics U.S.A. Inc., 1000 Sylvan Ave., Englewood Cliffs, NJ 07632; 800-777-1192, 201-816-2000; fax, 201-816-0636.*

Circle 449 on reader service card

MAG InnoVision Inc.

MAG InnoVision DX17F
MAG InnoVision MXP17F

By Brian Fikes

MAG InnoVision targets the low and high ends with its MAG InnoVision DX17F ($729 list, $650 street) and MAG InnoVision MXP17F ($999 list, $950 street). The DX17F has all of the features and performance that most business and home users need at a very competitive price. The MXP17F, intended for the graphics and CAD professional, is a solid performer but less of a standout.

Each offers a large, 16.2-inch diagonal

An informative LCD: The MAG InnoVision MXP17F features a slick LCD readout.

maximum viewable area. The DX17F we tested had excellent geometry, with straight, even lines. The color quality and focus were good, although very thin lines had lowered contrast, which made them more difficult to discern. Labs-based test results ranged from acceptable to good. This model includes front-panel controls for screen size and position, plus pincushion and tilt. It can achieve up to 1,280-by-1,024 resolution, though at only a 60-Hz vertical refresh rate; we recommend you choose 1,024-by-768 at a flicker-free 76 Hz.

The MXP17F gives you a much sharper picture and better color quality (it had the best color-tracking score of the group). But the main difference is in features. The MXP17F supports up to 1,600-by-1,280 resolution (again at 60 Hz) and higher refresh rates for the lower resolutions. In addition to the controls found on the basic model, the MXP17F has color and trapezoidal adjustments.

For $39.99, you can get MAG's Advanced Display Calibration software and a cable to connect the monitor to your PC's serial port; this allows you to adjust the monitor from your Windows desktop. An LCD on the front panel tells you the current resolution and refresh rates and also gives you feedback when you make adjustments. If you have two computers, you can connect them both to the MXP17F and switch between them with the input-select switch.

MAG provides a warranty of three years for parts, two years for the CRT, and one year for labor. It also offers extended warranty programs with yearly tune-up and trade-in options.

MAG InnoVision DX17F. *List price: $729.* **MAG InnoVision MXP17F:** *List price: $999. MAG InnoVision Inc., 2801 South Yale St., Santa Ana, CA 92704; 800-827-3998, 714-751-2008; fax, 714-751-5522.*

Circle 450 on reader service card

MaxTech Corp.

GVC M1766LR

By Gordon McComb

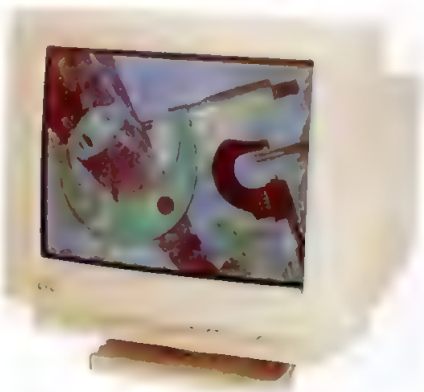
Considering its bargain-basement street price of about $599 ($749 list), you'd think the GVC M1766LR would be near the bottom on our lab and subjective tests. Surprise! The GVC came in average or above average on nearly all tests, in some cases outranking monitors costing hundreds of dollars more. If you're on a tight budget but want a good 17-inch monitor for business chores or home use, the GVC might be what you're seeking.

In subjective evaluation of pincushioning and barrel distortion, the GVC proved excellent. Likewise, its convergence was good, with no visible artifacts. Sharpness was fine except for the corners, where the focus was slightly soft. Lab tests showed the GVC to be remarkably capable. The monitor rated above average on the critical tests of Average MTF, RMS Misconvergence, and adjusted pincushioning. Its performance on our Spatial Uniformity test was below par, and we were unable to increase the brightness much beyond the "normal" setting of most other monitors.

The monitor offers on-screen feedback of its front-panel pushbutton controls, and it provides separate thumbwheels for brightness and contrast—a convenient touch. On the other hand, the labeling on the front-panel controls can be hard to see because the lettering is raised but not painted. Still, our quibbles are minor; MaxTech's GVC M1766LR is a good bet.

GVC M1766LR. *List price: $749. MaxTech Corp., 376 Lafayette Rd., Sparta, NJ 07871; 800-936-7629, 201-586-3008; fax, 201-586-3308.*

Circle 451 on reader service card



MaxTech GVC M1766LR: Good and cheap.

Now Everyone Can Have The Superior Monitor.

If you've always wanted a top performing monitor, now is the time.

Even the coolest dudes find Nanao's new 17" monitors way cool. The new F2·17EX and T2·17TS models can't be beat for the ultimate in text and graphics performance. Which is why they're setting sales records at savvy computer stores. Another reason is Nanao's Windows 95 Plug & Play* compatibility. Complicated user set-up adjustments at the time of installation are virtually eliminated. And switching resolutions on-the-fly is a snap. Users are also drawn by Nanao's reputation for outstanding long-term reliability plus the stunning array of new advanced technical features that are ideally suited for graphical environments. Nanao even offers a choice of four 17" models to satisfy your budget, application requirements and tube preference. The F2·17EX features an ultra fine dot pitch Invar shadow mask flat-square tube, while the T2·17TS features the new hybrid technology aperture grill tube. Both monitors provide the power you need to achieve true-to-life colors, crisp typography and a stable screen image. Flicker-free resolutions up to 1280 x 1024 @ 82Hz refresh rate, Colorific™ screen/printer color matching software and on-screen image controls deliver previously unheard of levels of performance. For added safety against emissions, TCO compliance is now available as a standard feature.

If you're wondering why this dude looks so satisfied, it's easy to figure out. He just caught the perfect wave. And the perfect 17" monitor.

F2·17EX	
Dot Pitch	0.26mm
Actual Viewing Diag.	16.1"
Scan Freq.	H:30-86kHz, V:55-160Hz
Rec. Resol.	1280 x 1024 @ up to 82Hz
Max Resol.	1600 x 1200 @ up to 66Hz
On Screen Control	ScreenManager™ and ScreenManager™ Pro
Standards	MPR-II, TCO, FCC B

T2·17TS	
Grill Pitch	0.25mm
Actual Viewing Diag.	16.0"
Scan Freq.	H:30-86kHz, V:55-160Hz
Rec. Resol.	1280 x 1024 @ up to 82Hz
Max Resol.	1600 x 1200 @ up to 66Hz
On Screen Control	ScreenManager™ and ScreenManager™ Pro
Standards	MPR-II, TCO, FCC B

*3-year warranty***

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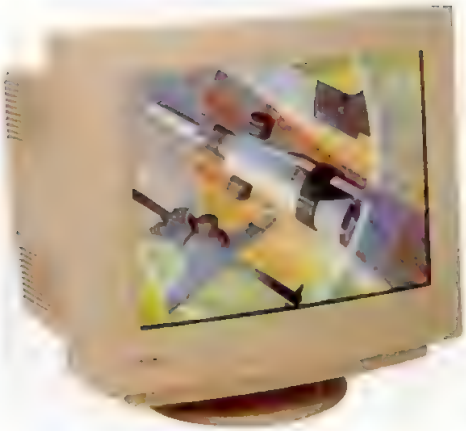

Mitsubishi Diamond Pro 17TX: Trinitron killer.

Mitsubishi Electronics America Inc.

Diamond Pro 17TX

BY JOHN R. QUAIN

If you hate to make compromises, you'll be impressed with Mitsubishi's Diamond Pro 17TX. This monitor is intended for the graphics professional and CAD user—in fact, it is not even FCC-approved for home use—and delivers performance and features commensurate with its $1,199 street price.

Based on Mitsubishi's vertically flat DiamondTron CRT, this unit is a strong competitor to monitors based on the only other such tube on the market—Sony's Trinitron. The Mitsubishi features BNC connections, Colorific color-matching software, a 0.25-mm dot pitch, a top resolution of 1,600 by 1,200 pixels (at 68 Hz), and DDC2B Plug and Play compatibility.

The monitor's on-screen controls provide an extensive range of adjustments, including the ability to correct any curvature of the left and right sides, adjust vertical and horizontal convergence, and reduce moiré distortion. Mitsubishi provides a Windows-based program that lets you control attributes using your mouse and keyboard, though you need a spare serial port to connect the monitor to your PC.

Perceptive users reaching for 1,280-by-1,024 resolution will notice that the DiamondTron tube—like Sony's Trinitron—has two thin horizontal lines cutting the screen into thirds. The lines are caused by nylon wires that stabilize the CRT's aperture grill. At most resolutions, the lines are barely noticeable, but some users may find them distracting.

The Mitsubishi frequently scored among the top ten on our tests, with very low RMS Misconvergence and excellent Spatial Uniformity scores. Interestingly, this Trinitron competitor outscored Sony's Multiscan 17sf on Average MTF and Color Tracking. Its images are well-focused and sharp. Although poor pincushioning results marred an otherwise unblemished performance, in subjective tests the pincushioning effect (which can be adjusted) hardly detracted from this otherwise outstanding monitor.

Diamond Pro 17TX. *Estimated street price: $1,199. Mitsubishi Electronics America Inc., 5665 Plaza Dr., Cypress, CA 90630; 800-843-2515, 714-236-6352; fax, 714-236-6172.*

Circle 452 on reader service card

Nanao USA Corp.

FlexScan F2•17
FlexScan F2•17EX
FlexScan T2•17TS
FlexScan T2•17

BY KATIE BARNES

PC MAGAZINE EDITORS' CHOICE

The four models in Nanao's new line of 17-inch monitors are masterpieces. It's unfortunate that they are also so pricey. But for high-end graphics users that demand the best possible image quality, the FlexScan T2•17 ($1,380 street) and FlexScan T2•17 TS ($1,149 street) aperture-grill monitors are unbeatable. The shadow-mask FlexScan F2•17EX ($1,098 street) and FlexScan F2•17 ($970 street) are marketed as more affordable solutions to the mainstream business user. In this capacity, the F2•17EX is outstanding, though it is only a few dollars less than the even-better, high-end T2•17TS.

Screen images were beautiful on all four monitors. Colors were excellent though more saturated on the T2•17 and T2•17TS. Sharpness, too, was a strong point. In fact, these Nanao offerings were the units to beat in our subjective evaluations; the F2•17 was not as good as its siblings, but it is still better than most mainstream business-oriented monitors.

The sharpest monitor in this roundup, the Trinitron-equipped T2•17, had the best Average MTF score. It also had outstanding linearity and very little misconvergence. Note that the T2•17 is also one of the most expensive monitors reviewed and lacks the port needed to utilize the ScreenManager Pro software. The T2•17TS, which employs Mitsubishi's new vertically flat CRT (the DiamondTron), is more reasonably priced. Given its excellent clarity and lack of visible convergence problems, you may not be able to tell the difference between this unit and its more expensive sibling.

Nanao's monitors provide much more than excellent performance, however, with an extensive array of features. All models use the same innovative control structure. The most commonly used controls are conveniently located at the bottom front of the monitor. But for more in-depth adjusting, you can enter Nanao's extensive yet easy-to-use on-screen menu for controlling everything from fine image quality to power management. In addition, three of the units (the T2•17 is excluded) ship with Nanao's ScreenManager Pro display software for Windows. ScreenManager Pro communicates bidirectionally through a serial cable connected from the monitor's maintenance port to a COM port on your computer, letting you control screen attributes using your keyboard and mouse. You can display test patterns to aid alignment of the image, and all settings are saved just as with the on-screen controls.

Sonnetech's Colorific color-management software, which lets you closely match the colors displayed on your monitor to the output of a color printer, is provided free of charge with all Nanao models. For graphics professionals who need more comprehensive color correction, Nanao offers FlexColor. This $275 pack-

Nanao FlexScan T2•17TS: Editors' Choice.

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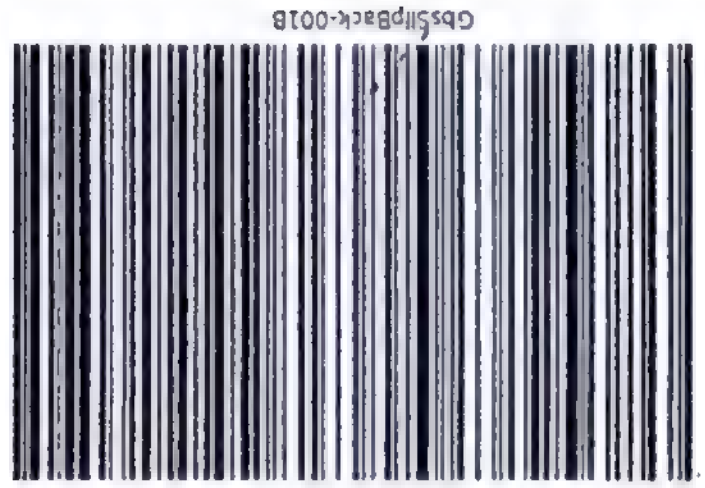

Back

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Inverted Back

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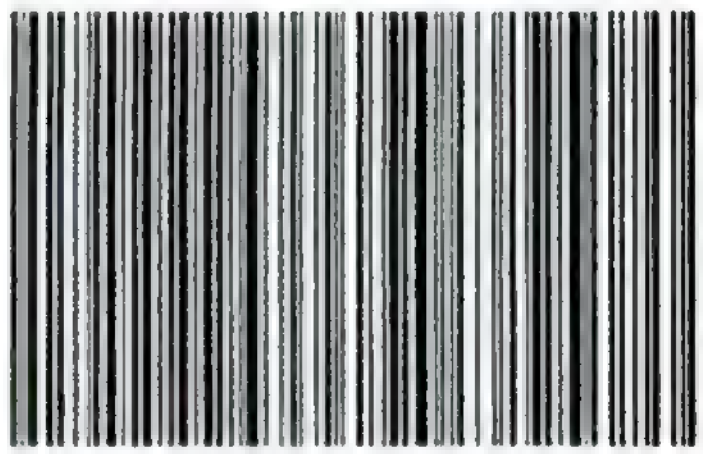

Foldout slip-sheet

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3. Slice the folded edge
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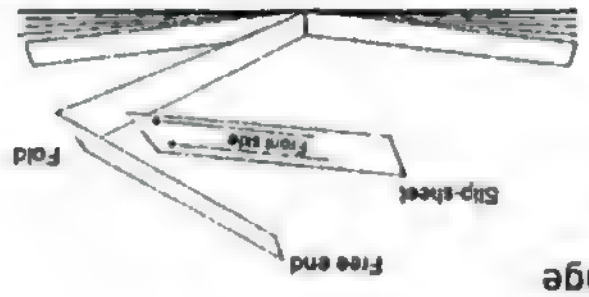

Inverted Foldout slip-sheet

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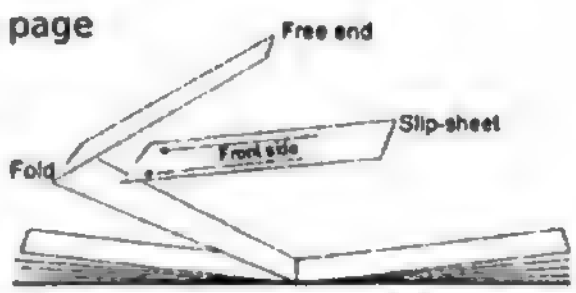

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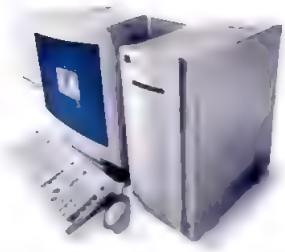

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ColorSync 2.0

12 ppm black, 3 ppm color

Windows 3.1 compatible

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The Power Macintosh 8500.

120 MHz PowerPC 604 RISC processor

Processor upgradable via daughterboard

3 PCI slots

3 expansion bays

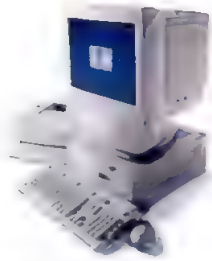
8 DRAM sockets

16MB to 512MB of DRAM

1GB or 2GB Fast SCSI hard disk

Built-in video-in/video-out capabilities up to 30 frames per second

Built-in 10Base-T and AAUI Ethernet



The Power Macintosh 7200 and 7500.

3 PCI slots

Built-in 10Base-T and AAUI Ethernet

7500

100 MHz PowerPC 601 RISC processor

Processor upgradable via daughterboard

3 expansion bays

8 DRAM sockets

16MB to 512MB of DRAM

Built-in video-in

7200

75 or 90 MHz PowerPC 601 RISC processor

4 DRAM sockets

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*Performance benchmarks based on Market Presence Inc.'s Power Macintosh 9500 Tests for Publishing June 1995 ©1995 Apple Computer Inc. All rights reserved. Apple, the Apple logo, AppleTalk, ColorSync, LaserWriter, Macintosh and The power to be your best are registered trademarks of Apple Computer Inc. Power Mac and Power Macintosh are trademarks of Apple Computer Inc. Adobe and PostScript are trademarks of Adobe Systems Incorporated or its subsidiaries and may be registered in certain jurisdictions. PowerPC is a trademark of International Business Machines Corporation, used under license therefrom. All Apple products are designed to be accessible to individuals with disability. To learn more (U.S. only), call 800 776 2333 or TDD 800 833 6223.

age bundles a precision color calibrator for measuring display characteristics and a software utility for extremely accurate color matching.

Resolution options and refresh rates are also outstanding. These Nanaos offer 1,280-by-1,024 resolution at flicker-free refresh rates of up to 80 Hz (except the F2•17, which can deliver 87 Hz at 1,024-by 768). All offer DDC2B Plug and Play capability. Three of the models (excepting the F2•17) use a special chemical antiglare treatment that reduces emissions to meet stringent TCO guidelines without degrading the focus. Each of the Nanao units includes a three-year warranty.

Nanao has artfully combined superb performance with outstanding features and has once again proven that you get what you pay for.

FlexScan F2•17. *Estimated street price: $970.* **FlexScan F2•17EX.** *Estimated street price: $1,098.* **FlexScan T2•17TS.** *Estimated street price: $1,149.* **FlexScan T2•17.** *Estimated street price: $1,380. Nanao USA Corp., 23535 Telo Ave., Torrance, CA 90505; 800-800-5202, 310-325-5202; fax, 310-530-1679.*

Circle 453 on reader service card

NEC Technologies Inc.

MultiSync XV17
MultiSync XE17
MultiSync XP17

BY JOHN R. QUAIN

Reliability and consistent performance are the traditional hallmarks of NEC monitors. The 17-inch MultiSync models—the low-end MultiSync XV17 ($799), corporate model MultiSync XE17 ($1,060), and high-end MultiSync XP17 ($1,099)—should satisfy a range of users. When it comes to display sharpness, however, other monitors surpass these NEC offerings.

All three models use similar flat-square tubes with 0.28-mm dot pitches and require a $69 lens to meet the TCO standard for low emissions. Each model's digital controls come with on-screen assistance to help you correct everything from small corner distortions to moiré patterns. You can even move the on-screen menu around the screen so that it doesn't always pop up in the center of your image. NEC's AccuColor on-board color control is also standard on these models. Only the more expensive XP17 ships standard with the Colorific software, but NEC will send it to you free if you buy the XE17 or XV17.

To board the ACCESS.bus: NEC's MultiSync XP17 is the only monitor we looked at that's on the bandwagon.

At the inexpensive end of the scale is NEC's small-office/home-office model, the XV17. It lacks the antiglare OptiClear coating of its two siblings, so you'll probably want the optional lens even if you don't need TCO compliance.

Like most 17-inch monitors, the XV17 runs best in its 1,024-by-768 setting, where the refresh rate is a comfortable 76 Hz; at 1,280-by-1,024, the refresh rate is only 60 Hz.

In general, the XV17 yielded below-average results on both lab and subjective tests. Image focus was slightly below par here with detectable misconvergence, and 6-point type looked cramped and was difficult to read. On the other hand, the XV17 delivered a picture with above-average Spatial Uniformity and Maximum Usable Brightness scores (though the results of the latter test are not shown).

Although the XE17 and the XV17 have nearly identical features, NEC bills the XE17 as its corporate model, while the XV17 is largely a retail product. The only features that distinguish the XE17 from the less-expensive XV17 are the antiglare coating and the included Macintosh-ready multicable. (NEC also ships the multicable with the XP17; it will send you a separate Mac adapter free for the XV17 on request.)

The XE17 did slightly better than the XV17. Although its brightness score was lower than the XV17's, the XE17's antiglare coating produced a more pleasing picture. The best aspects of the XE17 are its low overall misconvergence and good across-the-screen geometric and color uniformity. But again, small typefaces were difficult to make out on the XE17.

At $39 more than the XE17, the MultiSync XP17 is a better bargain. It comes with BNC plugs for professional graphics adapters and has forward-looking features, such as an ACCESS.bus serial connection for daisy-chaining compatible peripherals. Furthermore, it can display 1,280-by-1,024 resolution with an ergonomic 76-Hz vertical refresh rate.

The overall image quality of the XP17 is noticeably superior to that of the other two NEC models. Tiny type is more easily legible, and the picture remains clear and sharp. The XP17's overall focus and lack of pincushioning is above average compared with other units in this roundup. The XP17 also renders a bright picture with no detectable inconsistencies.

If you're trying to pick a model suited to your budget, the MultiSync XE17 looks like the odd man out here. With nearly the same basic features, the XV17 is significantly less expensive. On the other hand, if you require more advanced features to do high-end graphics applications, the XP17 is the better choice.

MultiSync XV17. *Estimated street price: $799.* **MultiSync XE17.** *Estimated street price: $1,060.* **MultiSync XP17.** *Estimated street price: $1,099. NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; 800-632-4636, 508-264-8000; fax, 508-264-8673.*

Circle 454 on reader service card

Nokia Display Products Inc.

Nokia Valuegraph 447L
Nokia Multigraph 447X

BY KATIE BARNES

Winner of two Editors' Choices in the past two years, Nokia is regarded as an innovative manufacturer of high-quality displays. A recipient of last year's

Nokia Multigraph 447X: A good combo.

Editors' Choice, the Multigraph 447X ($999 street) still holds its own, but its performance has been overtaken by some of this year's new products. Nokia also sells the speaker-equipped Valuegraph 447L ($699 street), which has impressive extras but only mediocre picture quality.

The 447X still offers the best combination of performance and features of any Trinitron-based 17-inch display. Its 0.25-mm dot-pitch tube achieved a well above-average MTF score and delivers outstanding brightness and uniformity. Its only weakness was some visible misconvergence, which was confirmed by its slightly below average objective score.

The 447X's large bandwidth allows it to display 1,280-by-1,024 resolution at a flicker-free 80 Hz. A TCO-compliant version is available for an additional $99.

Two buttons control the 447X's on-screen controls, which are among the most intuitive we've seen. You can easily correct just about any screen attribute, including convergence, orthogonality, and tilt.

The 447L, on the other hand, is a below-average performer, though acceptable for its price range. Its Hitachi shadow-mask tube, which has an 0.28-mm dot pitch, produced a fuzzy picture and scored low on our MTF test, and its color fidelity was among the worst in this roundup.

Optimally used in 1,024-by-768 resolution at 75 Hz, the 447L is intended for mainstream applications. Nokia sells this model in red, blue, green, charcoal, or beige colors to match your home or office decor. Two-watt-per-channel speakers, mounted invisibly under the bezels, deliver adequate sound quality but lack bass.

Although not as elegant as its sibling's on-screen controls, the 447L's digital controls, located at the unit's bottom front, offer plenty of adjustment options.

By the time you read this, Nokia will be selling the Valuegraph 447W, which has a 0.26-mm shadow-mask display that can reach 79 Hz in 1,280-by-1,024 resolution. The 447W will also come with 2-watt-per-channel speakers. Its price wasn't available at press time.

While the Multigraph 447X is no longer the absolute best performer, its superb image quality and elegant design make it a purchase you won't regret. And the Valuegraph 447L, the least expensive multimedia monitor in this roundup, is a reasonable compromise between the demands of sight and sound.

Nokia Valuegraph 447L. *List price: $699.*
Nokia Multigraph 447X. *List price: $1,199.*
Nokia Display Products Inc., 3000 Bridgeway Blvd., Sausalito, CA 94965; 800-296-6542, 415-331-0322; fax, 415-331-6211.
Circle 455 on reader service card

Panasonic Communications & Systems Co.

PanaSync C-1791Ei PanaMedia 17 PanaSync/Pro C-1792P

By John R. Quain

Taking a three-tiered approach to bigger displays, Panasonic's monitor offerings are designed with business and home users in mind. For the frugal buyer there's the PanaSync C-1791Ei ($899 list, $699 street), while those with more specialized needs can choose between the audio-equipped PanaMedia 17 ($999 list, $799 street) and the sharper image of the PanaSync/Pro C-1792P ($999 list, $849 street). Similar models are made by Panasonic (along with other suppliers) for ViewSonic, with the comparable ViewSonic monitors holding a slight performance edge. However, the price differences mean you may find a better bargain here.

The three Panasonic monitors are standouts in terms of convenience and ergonomic design. All the monitors offer Plug and Play DDC1 and DDC2B compatibility for Windows 95 users. With similar on-screen controls and features, the major difference between these and the ViewSonics is that the ViewSonics meet the stricter TCO emission specifications.

Panasonic's basic 17-inch model is the C-1791Ei, with a 0.27-mm dot pitch and a top noninterlaced resolution of 1,280-by-1,024 at 64 Hz (though we recommend the more eye-pleasing 1,024-by-768 at 85 Hz). The unit had reasonably sharp, detailed images. However, we did detect some pincushion distortion that its controls could not overcome. On our objective tests, the C-1791Ei turned in one of the poorest contrast ratios, which can affect sharpness, but it managed to yield one of the best overall MTF scores.

Based on the same CRT and boasting identical display features is Panasonic's multimedia-ready monitor, the PanaMedia 17. Encased in the chassis are stereo speakers and a microphone. On the side of the monitor are jacks for a pair of headphones and a stereo microphone, and on the back panel are connections to hook the monitor up to your sound card.

This tidy package can be a desk-clearing solution for those fumbling with cables in their multimedia setups. Although the built-in microphone is sufficient for voice annotations, unfortunately, as in the ViewSonic 17GA, the self-powered speakers are woefully underpowered (2 watts per channel). The frequency response of the speakers is also noticeably limited, lacking any low-end bass response.

When it comes to the PanaMedia 17's performance, there isn't much to shout about. Although its on-screen image is acceptable, it falls below the average in several respects: It lacked some crispness on our misconvergence test, and pincushion distortion was a nagging problem once again.

Serious CAD/CAM users can glean a better picture from the PanaSync/Pro C-1792P. The PanaSync/Pro offers a finer dot pitch (0.25 mm) and higher resolutions: 1,600-by-1,280 resolution at 62 Hz

Panasonic PanaMedia 17: Sound and vision.

How Do You Tell If It's A "Trinitron"?

or 1,280-by-1,024 at an acceptable 77 Hz. It also offers a few more high-end amenities, such as moiré and image-rotation adjustments and BNC connectors.

The finer CRT does pay off here in general image accuracy. Small fonts looked slightly clearer. Pincushioning problems, while not completely eliminated, were not nearly as noticeable as with the others.

Panasonic backs the trio with a three-year warranty on both parts and labor, with on-site replacement the first year—the best warranty we've come across. But in terms of flat-out image quality, these three monitors aren't market leaders: Their strength is value in a convenient design.

Panasonic PanaSync C-1791Ei. *List price: $899.* **Panasonic PanaMedia 17.** *List price: $999.* **Panasonic PanaSync/Pro C-1792P.** *List price: $999. Panasonic Communications & Systems Co., 2 Panasonic Way, caucus, NJ 07094; 800-742-8086, 201-348-7000.*

Circle 456 on reader service card

Philips Consumer Electronics Co..

Philips 17B

BY KATIE BARNES

Targeted for the general business user, the Philips 17B monitor offers acceptable performance and a wealth of features for a moderate street price of $799 ($899 list). With poor color tracking and spatial uniformity on our labs-based tests, the 17B is unsuitable for high-end or graphics users: Colors appeared dull, and the corners of the display were noticeably darker than the center. We also observed some linearity distortion (the image looked stretched outward from the center), which rules the Philips out for CAD applications.

Philips 17B: A wealth of features.

Princeton Ultra 17: A modest disappointment.

As a general-purpose monitor, though, it displays a sharp, pleasing picture.

Philips hasn't skimped on the features a business user might want. The 17B is Plug and Play–compatible. It has built-in speakers, a headphone jack, and connectors for your sound card. Although sound quality would be better if the speakers faced toward the user rather than the sides, it was decent. On-screen controls make adjusting the image easy, and you can fine-tune the tilt, color matching, and trapezoidal adjustments. Better still, the active screen size is a generous 16.2 inches (diagonal), the largest of any display in this roundup.

Though its picture quality is not geared to CAD or DTP users, this Philips unit is fine for everyday business chores.

Philips Model 17B. *List price: $899. Philips Consumer Electronics Co., One Philips Dr., P.O. Box 14810, Knoxville, TN 37914-1810; 800-835-3506.*

Circle 457 on reader service card

Princeton Graphic Systems

Princeton Ultra 17

BY GORDON MCCOMB

Acquired by fellow monitor maker MAG InnoVision, Princeton Graphic Systems is now targeting the home user in addition to its traditional corporate accounts. The model the company submitted for this roundup, the Princeton Ultra 17, proved to be a modest disappointment. Though it is priced for the cost-conscious buyer ($689 list, $640 street), the Ultra 17 demands too many trade-offs to make it a good value. Picture quality was lacking in some measures, borne out by both our subjective and labs-based tests.

In the Ultra 17's favor, overall picture sharpness was acceptable even in the corners on our subjective evaluation, though it rated below average on our objective MTF test. But the image did show an excessive amount of misconvergence, which was pronounced at the top corners and at the bottom left. We also detected some moderate pincushioning and barrel distortion at the top and bottom, which could not be corrected. Labs scores here, too, were below par.

Unfortunately, there's nothing about this monitor to recommend. There are other low-cost monitors with better performance to choose from.

Princeton Ultra 17. *List price: $689. Princeton Graphic Systems, 2801 S. Yale St., #110, Santa Ana, CA 92704; 800-747-6249, 714-751-8405; fax, 714-751-5736.*

Circle 458 on reader service card

Radius Inc.

Radius Precision View 17

BY GORDON MCCOMB

Radius has long been respected in Macintosh circles. The Trinitron-based Precision View 17, priced at $1,099 ($949 street), is Radius's current attempt to address the IBM PC graphics market. But despite this product's above-average price tag, its performance did not distinguish it from the pack.

The Radius is manufactured by Sony and has many similarities to the Multiscan 17sf. Indeed, in many tests, the pricier Radius did only marginally better or worse than the Sony. The Radius earned subpar scores on misconvergence and brightness but delivered one of the best overall performances on our Color Analyzer tests, as

Radius Precision View 17: Lost in the pack.

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†Additional Type-I, Type-II and Type-III PCMCIA slots are available with optional modules. Specifications are subject to change.

evidenced in the display's exceptionally vibrant colors.

The Radius performed well overall on our subjective test for geometric distortion. But we found a peculiar distortion that warps the screen image in the upper left corner, a defect we could not correct. We also noticed that the Radius's focus went soft in the corners of the screen.

Most monitors in this price range have on-screen controls, but the Radius doesn't. And like the Sony Multiscan 17sf, it lacks a degaussing button.

The Radius comes with a one-year overnight replacement warranty, a generous policy but perhaps not worth the $100 premium over the Sony.

Radius Precision View 17. *List price: $1,099. Radius Inc., 215 Moffett Park Dr., Sunnyvale, CA 94089; 800-227-2795, 408-541-6100; fax, 408-541-6150.*

Circle 459 on reader service card

Sampo Technology Inc.

AlphaScan 17gx

BY GORDON MCCOMB

Priced at $799 ($725 street), the Sampo AlphaScan 17gx is targeted at the bargain-conscious buyer who still wants quality and a recognizable brand name. The AlphaScan impressed us both in our subjective quality assessments and on our labs-based tests.

This unit was one of the models we purchased randomly through the retail channel. While its quality was acceptable, its screen did not look as sharp as the one on the unit Sampo sent. Sampo reports that our purchased unit was an older model, and that several engineering improvements have been made since it was shipped. Units produced after March 1995 should have the improved component.

There was no discernible pincushioning or barrel distortion on the monitor, and the colors appeared bright. Convergence was excellent in all areas of the screen except the bottom left and right, where a very slight amount of red and blue shift could be seen among the thin white lines of our test pattern. We could also discern a faint moiré pattern in the corners. Even with these imperfections, however, the Sampo presented a well-defined picture.

Hey, guys—fix these: We liked the Sampo AlphaScan 17GX but hated its controls.

If there's a down-side to the Sampo, it's the engineering of the front-panel controls. The monitor uses digital push buttons to adjust all user-defined settings, and you must press a Mode button to access some of these attributes. Because of this arrangement, we found ourselves constantly adjusting the wrong controls during testing.

AlphaScan 17gx. List price: $799. Sampo Technology Inc., 5550 Peachtree Industrial Blvd., Norcross, GA 30071; 404-449-6220; fax, 404-447-1109.

Circle 460 on reader service card

Samsung Electronics America Inc.

SyncMaster 17GLi
SyncMaster 17GLsi

BY SEBASTIAN RUPLEY

PC MAGAZINE EDITORS' CHOICE

Samsung has two new offerings for 17-inch monitor buyers. The SyncMaster 17GLi ($799 list, $699 street) is aimed squarely at the mainstream business market and is suitable even for some DTP and graphics chores. The SyncMaster 17GLsi ($999 list, $949 street) is intended for more demanding graphics and is aimed at CAD/CAM users. We were impressed with the picture quality and feature sets of both units, and their relative value makes them top choices.

The more expensive 17GLsi model boasts a 0.26-mm dot pitch (compared with the 17GLi's 0.28-mm dot pitch) and can deliver resolutions of up to 1,600-by-1,280 at a 68-Hz refresh rate. We recommend a resolution of 1,280-by-1,024 at 80 Hz. Maximum noninterlaced resolution for the lower-end 17GLi at a VESA-compliant refresh rate is 1,024-by-768 at 80 Hz.

Both SyncMasters offer DDC2B-compliant Plug and Play capabilities and on-screen menus for their easy-to-use and well-designed drop-down control panels.

We came away from subjective testing very impressed with the 17GLsi. Its crisp, bright display is nearly flawless. The 17GLi also showed excellent focus and good colors, although its screen uniformity was slightly inferior. Both monitors managed generally above-average showings on our tests, especially compared with other units in their respective price ranges.

SyncMaster 17GLi. List price: $799. **SyncMaster 17GLsi.** *List price: $999. Samsung Electronics America Inc., 105 Challenger Rd., Ridgefield Park, NJ 07660; 800-726-7864; fax, 201-229-4000.*

Circle 461 on reader service card

Show these to Sampo: The controls on Samsung's SyncMaster 17GLsi are nicely done.

Samtron SC-726DXL: No disappointment.

Samtron Displays Inc.

Samtron SC-726DXL

BY SEBASTIAN RUPLEY

With the Samtron SC-726DXL ($950 list, $875 street), Samtron Displays hopes to win over mainstream business and graphics professionals, and possibly low-end CAD/CAM users. You may be able to find more features in a monitor that costs just a little more, but you won't be disappointed by the Samtron's picture quality.

The monitor is capable of a maximum resolution of 1,280-by-1,024 at a VESA-compliant refresh rate of 76 Hz. The monitor's on-screen control panel is well laid out and lets you make advanced adjustments such as color matching, pincushioning, and trapezoidal alignment.

We found the Samtron to be a top monitor during testing. It performed quite well overall on subjective testing, although flesh tones on our color tests were slightly washed out. Labs-based testing also showed the monitor to be good or excellent on most measures.

Samtron SC-726DXL. *List price: $950. Samtron Displays Inc., 18600 Broadwick St., Rancho Dominguez, CA 90220; 800-726-8766, 310-537-7000; fax, 310-537-1033.*

Circle 462 on reader service card

Smile International Inc.

Smile CA-1706M2

BY SEBASTIAN RUPLEY

Smile International (which formerly sold monitors here under the KFC-USA label) intends its Smile CA-1706M2 to appeal to high-end users, and the monitor generally offers a good price/performance balance. The $775 Smile ($900 list) did well on several of our tests, although it lagged on the Average MTF and Color Tracking tests. For CAD/CAM or graphics users with stringent demands, some other monitors may prove better. Our subjective evaluation of the Smile monitor, however, revealed it to be more than acceptable for typical business applications and suitable even for desktop publishing needs.

The Smile is capable of a maximum resolution 1,600-by-1,280 with a refresh rate of 60 Hz; a more comfortable display can be had at 1,200-by-1,024 at a flicker-free 75 Hz. The monitor offers a useful below-screen LED that reports on current resolution, the status of controls, and more.

During subjective testing, the Smile did well. Color images were clear and uniform. Very mild fuzziness was apparent on the focus and bandwidth tests, confirmed by a below-average score on our labs-based MTF test. Objective pincushioning results placed the Smile near the front of the pack.

The Smile CA-1706M2 offers a solid feature set at a very reasonable price, and its picture quality should prove good enough even for DTP users.

Smile CA-1706M2. *List price: $900. Smile International Inc., 1575 Sunflower Ave., Costa Mesa, CA 92626; 714-546-0336; fax, 714-546-0315.*

Circle 463 on reader service card

Lighting your way: The Smile CA-1706M2 has an LED readout to display status information.

Sony Multiscan 17sf: The cheapest Trinitron.

Sony Electronics Inc.

Multiscan 17sf

BY GORDON MCCOMB

Sony's Multiscan 17sf ($999.95 list, $829 street) is an enticing combination of performance and price. Other Trinitron- and DiamondTron-based monitors in this roundup beat the Sony on image quality and features, but they can't match the Sony's price.

The Sony's CRT performed well during subjective testing, with a particularly bright display and lively colors. The display's corners had no noticeable misconvergence, though we noticed some bleeding in the very top and left edges of the display. We also were unable to correct barreling in the upper-left-hand corner of the screen. Focus was average at the center of the screen but softened in the lower-right-hand corner. We found italic 6-point type blurry and difficult to read.

The Sony's MTF, adjusted pincushioning, and misconvergence performance placed it in the below-average ranks. But the display earned an exceptional score on our Spatial Uniformity test, and its Maximum Usable Brightness score was also above average.

The Sony doesn't have on-screen controls or a manual degaussing button. The unit also lacks many of the advanced controls—such as convergence and tilt—that have become common on monitors of this size. Still, it's the least expensive Trinitron-based display in this roundup and is a good value.

Multiscan 17sf. *List price: $999.95. Sony Electronics Inc., 3300 Zanker Rd., San Jose, CA 95134; 800-352-7669, 408-432-0190; fax, 408-955-5171.*

Circle 464 on reader service card

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TVM AS6G: We saw better.

TVM Corp.

TVM AS6G

BY STEVE BUEHLER

The TVM AS6G ($649 list, $599 street) is a bare-bones product with performance as lacking as its design is frugal.

We noticed several obvious defects in the TVM's image, and its labs-based results were among the worst in this roundup. Subjective testing revealed a distinct lack of sharpness, slight bowing, and minor bleeding on both sides of the screen. Text at 7.5 points and smaller was quite difficult to read, and serif fonts were especially muddy at these smaller sizes. Other monitors we looked at delivered comfortably legible type down to 6 points.

Like most models designed for the upgrade market, the TVM should be used at 1,024-by-768 at 75 Hz, though it is capable of 1,280-by-1,024 at 60 Hz.

Most controls are well marked and easy to access, but the degaussing button is at the rear of the unit. The video-signal cable also is permanently attached to the monitor, making its replacement difficult.

The company also sells the TVM AS6G+ ($749 list, $709 street), a model capable of reaching 1,280-by-1,024 resolution at 82 Hz; its Hitachi tube has a dot pitch of 0.26 mm.

We cannot recommend the TVM for even semiserious color or text work. Even if price is your overriding concern, you needn't settle for the TVM AS6G.

TVM AS6G. *List price: $649. TVM Corp., 4260 E. Brickell St., Ontario, CA 91761; 909-390-8099; fax, 909-390-8060.*

Circle 465 on reader service card

ViewSonic Corp.

ViewSonic 17GS
ViewSonic 17GA
ViewSonic 17PS

BY JOHN R. QUAIN

ViewSonic has addressed each type of user with its monitor line. The 17GS ($895 list, $795 street) is aimed at the business user; the 17GA ($995 list, $895 street) is designed for sound and video; and the 17PS ($1,095 list, $995 street) is targeted at users whose sights are set on a high-end DTP or CAD display. All three units have a generous array of features. But while the high-end 17PS displayed excellent image quality overall, the lower-priced models left us wanting.

Closely related to Panasonic's 17-inch monitor family also reviewed in this feature, the ViewSonic displays have a marginal performance edge over the three Panasonic units; however, they command higher prices. Each features Plug and Play (DDC1 and DDC2B) compatibility, and Sonnetech's Colorific software is free with the 17PS ($19.95 with the other two). All three feature superior on-screen controls, noteworthy for their ease of use. The major difference between these units and Panasonic's is that the ViewSonic monitors meet the stricter TCO emission standard.

Closely related to Panasonic's 17-inch monitor family, the ViewSonic displays have a marginal performance edge and meet the TCO emissions standard.

Featuring a 0.27-mm dot pitch, the mainstream 17GS offers a maximum non-interlaced resolution of 1,280-by-1,024, though the image is better in 1,024-by-768 mode, which has a more pleasing 86 Hz. Of the three ViewSonic monitors tested, the 17GS had more weaknesses than strengths. It had one of the poorest contrast ratios and one of the lowest overall MTF scores; the combination translated into a slight lack of image detail. Also, when we switched to a DOS box from Windows (with the brightness at a comfortable level), we found the background had a grayish tinge rather than solid black.

The sister monitor to the 17GS is the audio-outfitted 17GA. Besides having the same basic display, the 17GA comes with built-in stereo speakers neatly integrated into the front bezel and a small microphone located just below the screen. On the front left side are jacks for headphones and an external mike; the back panel has stereo audio inputs that can be hooked up to your PC's sound board.

While this is a convenient setup, the sound quality (like that of most monitor-mounted speakers we've heard) is less than optimal. The speakers' frequency response reaches down to only about 70 Hz, and the built-in amplifier is rated for a mere 2.8 watts per channel (peak). The resulting sound leans toward the tinny side, with only enough volume to satisfy office cubicle listeners.

Even though the 17GA has many of the same image features as the 17GS, sharpness seemed much better. As with the 17GS, blackness levels were an issue.

The 17PS—the most expensive of these three offerings—has a finer 0.25-mm dot pitch and is able to achieve a higher 1,600-by-1,280 resolution with a 66-Hz vertical refresh rate. (A more ergonomic 77-Hz refresh rate is available in 1,280-by-1,024 mode.) The 17PS also has additional moiré controls (horizontal and vertical) and the ability to switch between the monitor's BNC and 15-pin VGA inputs.

ViewSonic 17PS: Feature-rich.

The 17PS offered a finer, more detailed picture, allowing us, for example, to read 6-point type more easily here than on the other two monitors. On the other hand, despite above-average spatial uniformity and color-tracking scores, the DOS black-level problem persisted, and convergence was less than perfect.

In all, the ViewSonics emphasize features and convenience over image quality. But for those looking for comfort rather than performance, these monitors are reasonable choices within their respective categories.

ViewSonic 17GS. *List price: $895.* **ViewSonic 17GA.** *List price: $995.* **ViewSonic 17PS.** *List price: $1,095. ViewSonic Corp., 20480 Business Pkwy., Walnut Creek, CA 91789; 800-888-8583, 909-869-7976; fax 909-8697958.*

Circle 466 on reader service card

ZDS ZCM-1740: Yes.

Zenith Data Systems Corp.

ZDS ZCM-1740

BY SEBASTIAN RUPLEY

Priced at $999 ($899 street), ZDS's ZCM-1740 monitor ranked among the best displays in this roundup. On our subjective tests, its screen image was crisp and sharply focused. Even 4-point type looked clear and sharp. Colors were especially vibrant, and flesh tones appeared genuinely natural.

On our labs-based tests, the Trinitron-equipped ZDS monitor absolutely shone, achieving exceptional scores for brightness, MTF, misconvergence, and spatial uniformity. Its only weak score was for color tracking, which did not detract from its excellent image quality. This display reaches 75 Hz in 1,280-by-1,024 resolution, making it suitable for CAD/CAM work or high-end graphics tasks.

Although most displays in this price range have on-screen controls, the ZDS does not. Its digital controls, however, are easy to use and cover just about every adjustment you might need to make to your monitor.

The ZDS is an extremely sturdy, top-performing monitor. If you like the look of a Trinitron tube, this is the best deal going. □

ZDS ZCM-1740. *List price: $999. Zenith Data Systems Corp., 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-533-0331; 708-808-5000; fax, 800-472-7211, 708-808-4434.*

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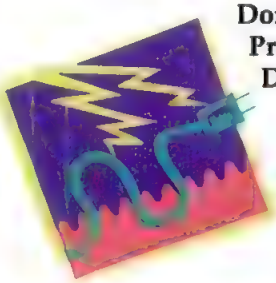

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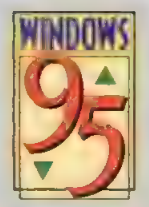
CIRCLE 055 ON READER SERVICE CARD

Waiting for WINDOWS 95



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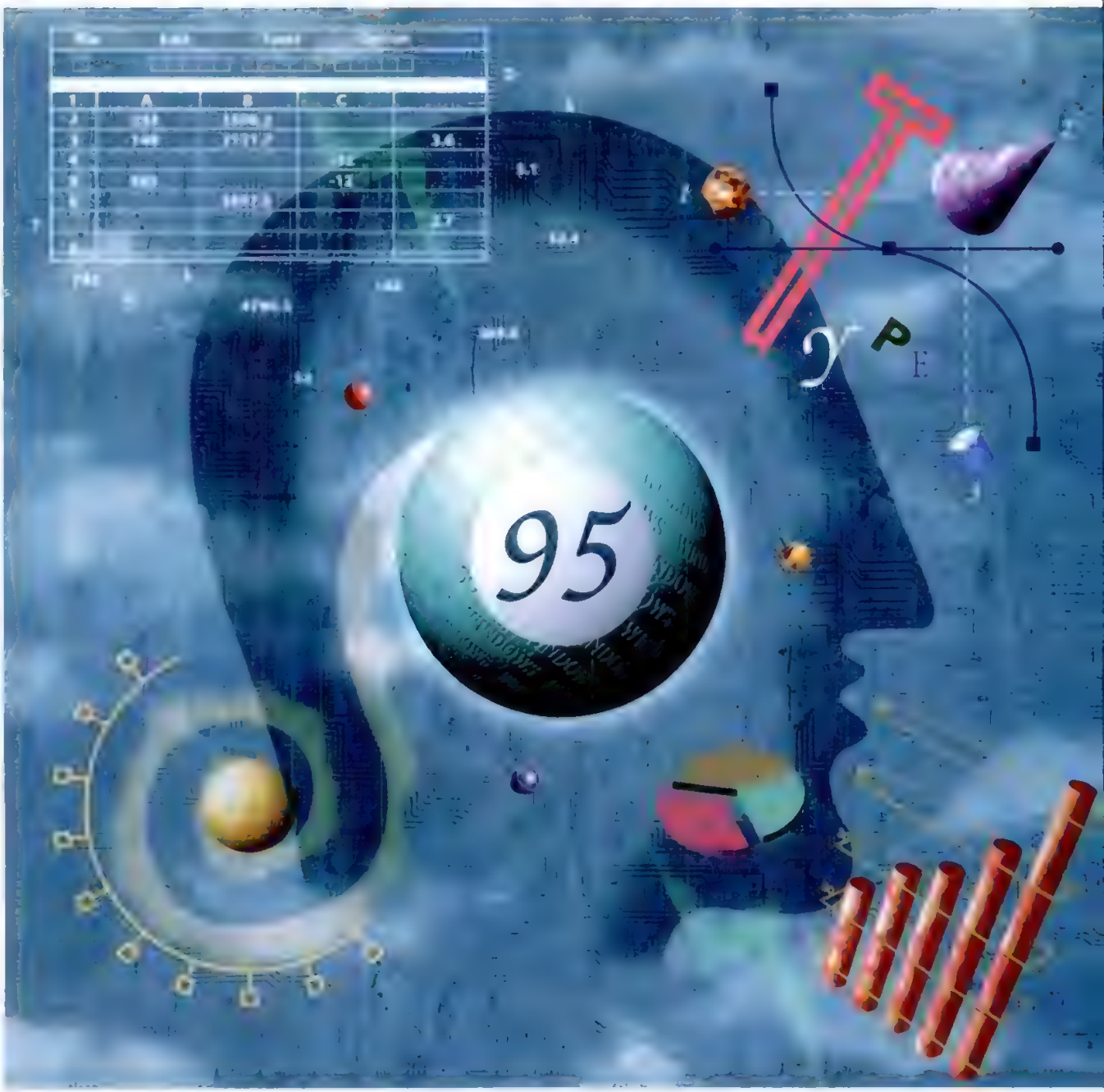
It seems the wait for Microsoft Windows 95 gets harder the closer we get. While we're waiting, this issue offers several stories designed to help get you ready for the impending operating system. In the story that follows, our editors preview 53 new applications designed for Windows 95 (most of which also run on Windows NT) and describe another 44 not yet available in beta releases, finishing with a look at 15 of the latest OS/2 applications.

For those of you actively contemplating a move to Windows 95, there's a special report "The Windows 95 Upgrade Clinic," along with information on how to upgrade your device drivers to support the latest operating systems. Included here is a comprehensive list of Windows 95, Windows NT, and OS/2 drivers and where to find them.

Our newly redesigned PC Tech section provides a wealth of information on up-and-coming operating systems, including Windows 95 and OS/2. And be sure to join us next issue for the real Windows 95 (at long last), and see how it stacks up against OS/2, Windows NT, and Windows 3.1 in head-to-head lab tests.

ILLUSTRATIONS BY MATSU/RENARD REPRESENTS



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Icons by John Lund, Windows logo by Jim Lebadd

NEW SOFTWARE FOR NEW WINDOWS

The new 32-bit applications: You've heard the rumors; you've seen the ads; the suspense is getting almost overwhelming. What's the substance behind all the promises? Check out our sneak preview of nearly 100 hot new up-and-coming products and see for yourself.

by Ted Stevenson

Time has been standing still. For well over a year, we've heard software publishers sing variations on the theme: "We're not upgrading this product; our development efforts are going into a Windows 95 version." But the waiting is almost over.

Windows 95 will be here at any moment, and we've searched the landscape high and low, scouting out the advance guard of new 32-bit software applications—the forerunners of a vast and powerful legion that promises to consign its Windows 3.*x* predecessors to the history books. By press time, we'd found more than 50 such products in 16 categories (mostly in prerelease versions) and gotten wind of more than 40 additional packages waiting to move to the front lines later in the year. Putting them all together, we offer a grand total of 97 product debuts.

Amid the fanfare and excitement of Win 95's debut, however, lurks some potential confusion: What *is* a Win 95 application? It's not just any program that will run under the new OS, since one of Win 95's fundamental design criteria was backward compatibility with DOS and Win 3.*x* file systems and application software. Most of the products you already know and love are probably *Windows 95–compatible* or *Windows 95–compliant* (which seem to mean little more than "It will run without crashing").

In a few special cases, though, compliancy means adapting to architectural features of the new OS that are totally different from their Win 3.*x* counterparts. One example is modem-based communications, where TAPI, Win32 communications APIs, and the UniModem driver make up a brand new universe for communications device-and-data management. As a result, many publishers of modem-based programs

Micrografx Picture Publisher
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Microsoft Word for Windows 95

have done some—but not all—of the major work of converting to Win 95 just to establish basic compatibility.

THE REAL THING

To obtain full Win 95 status—known as *Windows 95–compliant* or *native* applications—and the Win 95 logo, an application must meet a set of criteria defined by Microsoft itself. This Microsoft seal of approval indicates that products will integrate smoothly into the Win 95 world, sharing the OS's characteristic look, feel, and way of doing things.

The guidelines are quite explicit on many points. For example, native Windows 95 products implement OLE 2.0 both as container and object, use drag-and-drop, and conform to Win 95 interface conventions like long filenames, tabbed dialogs, and extensive use of the right mouse button. Interestingly, programs must also run under Windows NT (and thus many native NT applications qualify). See our sidebar "Making the Grade: Windows 95 Compliance" for full details on Win 95 logo requirements.

WHAT WE FOUND

In the pages that follow, we offer preview coverage of the 53 new products we were actually able to load up and work with (again, in almost all cases, prerelease versions), plus brief announcements of the 44 additional entries that weren't yet available even in prerelease versions.

For the most part, the products we cover here were built specifically for Windows 95, although some were originally designed to run under Windows NT. (This is likely to be a short-term distinction, since Microsoft plans eventually to smooth over the incompatibilities between the operating environments—at least they apply to most applications categories.). In a few cases, they are Win32s products heading toward full Win 95/Win NT status. To balance the perspective across 32-bit Intel-based platforms, we also include a survey of graphical applications for OS/2 (see the sidebar "What's New With OS/2?").

This preview may be only a hint of things to come, but already there's a wealth of innovative software to contemplate. As you read on, keep in mind that product names and release dates that we mention may change, so check details with the vendors in question.

CAD & 3-D SOFTWARE

Although several CAD vendors have expressed interest in porting to the next Windows platform, only a handful were ready to show their wares. As for 3-D software, Windows 95 is taking us to the next dimension.

MicroStation 5.5

With MicroStation, Version 5.5, Bentley Systems (800-778-4274, 610-458-5000) introduces what it considers its first *complete* Windows version of MicroStation. The powerful 2-D and 3-D professional-level CAD program no longer relies on Windows Connection Access to run in the GUI environment. A Win32s app, it runs under Windows 95, Windows NT, and Windows 3.1. Testing for Windows compliance wasn't completed at press time (nor was the logo). Bentley plans to ship the product around the same time as Win 95. Pricing is expected to be around $3,950 (list price), with several cheaper upgrade options available.

Bentley has also completely revised the product's interface, combining the once separate (or modal) MicroStation elements into one consistent interface. In addition, Bentley has replaced MicroStation's venerable command line, though you can still access it if you like. Stalwart MicroStation users may be overwhelmed at first by the array of buttons and views, but should ultimately find themselves working more efficiently. At press time, Version 5.5 was being tested for compatibility with Microsoft Office. It does, however, include dockable tool boxes, a status bar, tool tips, and other Office-type features.

Two other major enhancements are AccuDraw and SmartLine. The former provides a drawing plane to help users more accurately position and orient

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WANT TO GO
TODAY?™

Good question
Microsoft.

points as they draw in a two- or three-dimensional space. SmartLine is a collection of drawing tools that helps you create complex objects more easily.

Visual CADD 2.0

By the end of this year, Numera Software (800-956-2233) is poised to launch a Windows-compliant upgrade of its graphical 2-D CAD product, Visual CADD 2.0. In addition to all the features necessary to earn the Win 95–compliance label, the prerelease version of Visual CADD 2.0 adds user-defined viewports, bird's-eye view, grips to manipulate drawings more easily, Reference Entity, scroll bars, Direct Plot, 2-D Booleans, and ordinate dimensions.

Among these tools, two enhancements stand out: the bird's-eye view, which offers a persistent, long-range view of the drawing without forcing you to zoom out each time you want to orient yourself; and grips, which are analogous to handles in traditional drawing applications.

Visual CADD 2.0, with an anticipated release date sometime in the third quarter of 1995, plans to use the multithreading capabilities available under Win 95. (In the preview we saw, these capabilities weren't fully implemented.) As a Windows-compliant app, Visual CADD 2.0 should also include support for long filenames and Office 95 Binder support. The anticipated list prices are $595 and, for upgrades from 1.2, $99.

AutoCAD, Release 13

Autodesk (800-435-7771, 415-507-5000) officials say they plan to port their popular AutoCAD, Release 13, CAD software to the new Windows platform. Already 32-bit (using Win32s to run on Windows 3.1), AutoCAD should feature several Windows-compliant additions when the next version ships (about one month after Windows 95 for these list prices: CD-ROM, $3,750, and disks, $9,995), including right mouse button functionality. But the lack of extensive mail capability may keep it from qualifying for the Win 95–compliant logo.

DesignCAD

Last year's affordable 2-D CAD Editors' Choice, DesignCAD 2D for Windows, from American Small Business Computers (800-233-3223), is also in the process of being moved to Windows 95. A prerelease version wasn't available, but we got a peek at a preview of its DesignCAD 3D, Version 5.0, for Windows 95. The application, expected to be fully Win 95–compliant, should ship within 30 days after the operating system. At $495, the product will include a 2-D drafting mode, enhanced dimensioning commands, a faster 32-bit architecture, dockable menus, and tabbed dialog boxes.

Making the Grade: Windows 95 Compliance

By Kathleen Caster

As software companies scramble to build or retool their applications to run on Windows 95, many are hoping to get the Microsoft stamp of approval—the Windows 95 logo—on their packaging. And Microsoft has some strict guidelines about what entitles a product to carry that logo. To make the grade, an application must meet the following standards:

1. It must be a Win32 API executable.

2. It must have Windows 95 UI/Shell support and follow the *Microsoft Windows User Interface Design Guide*.

3. It must be tested on the latest version of Windows NT.

4. It must support long filenames.

5. It should be—but doesn't have to be—aware of Plug and Play events.

Applications that aren't file-based or that run exclusively in full-screen mode have to comply with the five basic rules only. A file-based application—one that provides Open, Save, and Close menu options—must follow additional rules:

6. It must support Universal Naming Conventions (UNC) pathnames.

7. It must have OLE 2.0 container or Object support and OLE 2.0 drag-and-drop support. We recommend OLE compound file support and OLE 2.0 Automation support.

8. It must support simple-mail-enabling (Send Mail functionality) using MAPI or CMC API.

Utilities like disk optimizers and antivirus software must follow Rules 1 through 4; we recommend they follow Rules 5 through 8 as well. (Rule 6 is required if the product accesses network resources.)

Compilers and other development tools must be able to generate applications that can meet all Windows 95 logo requirements. They must also comply with Rules 1 through 6, although there are some exceptions to Rule 2. Rule 8 is recommended but not required.

OLE Automation and drag-and-drop support are also recommended. If a product doesn't have OLE Container or Object support by default, there must be some automated functionality, such as a wizard, to help the developer add object support. □

But what about tomorrow?

Ask Windows users where they want to go today, and their answer is likely to be this: Windows 95. It is, after all, a major advance in the state of Windows computing. And it does, finally, bring some of the innovations pioneered by Apple in 1984 to the PC desktop of 1995.

While other PC manufacturers are still struggling to get CDs to load, Macintosh users can create their own multimedia, work in 3-D, surf the Internet and see what's real about virtual reality. Today.

That's great, today. But where, one has to ask, is desktop computing going tomorrow? And is moving to Windows 95 really the right way to get there?

The future of computing.

In a word, it's multimedia. Microsoft and Intel say it's the future. So do we. The difference is, we deliver that future today. To see what we mean, simply turn a Power Mac™ on. When you do, you can not only get down to work (or play) with the CD-ROM of your choice, you can also start using 3-D graphics. You can talk to your Mac.™ And have it recognize your command. You can videoconference across continents. You can even dive into virtual reality.* All at the touch of a few keys and the click of a mouse.

The power to do it.

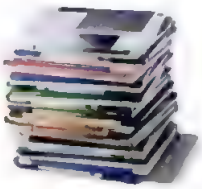
To do all this, you need power. And the best way to get it is with a Power Mac. In recent tests, for example, the RISC-based Power Macintosh™ 9500 outperformed a 120 MHz Pentium-processor-based PC by 63% on average. When running scientific and technical apps, the performance advantage jumped to 80%. And for graphics, the Power Mac was more than twice as fast.**

Because Power Mac computers are based on the blistering fast PowerPC™ RISC chip, they have power to spare for tomorrow's advanced applications like interactive media and virtual reality.

Eleven years after it was first introduced, Macintosh is still the only personal computer in the world designed from the start as a seamless integration of hardware and software.

The easiest way to get there.

Of course, all the raw power in the world is worthless if you can't use it. That's why every new Mac includes an innovative help system that doesn't just answer your questions, but shows you what to do, where to click and what to type to get things done. And why we make it so easy to create Internet connections, install new software and set up entire new networks from scratch.



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Today, every new Macintosh® can read and write DOS and Windows disks. But our compatibility goes further than that. The Power Macintosh 6100/66 DOS Compatible, for example, runs thousands of DOS and Windows applications, in addition to thousands of programs for Macintosh. And our new Power Mac systems accept standard PCI cards.

In the future, Apple innovations will further break down the barriers between cross-platform collaboration. Distinctions between the platforms themselves will diminish. Even the boundaries between applications will blur.

All of which will add up, once again, to the most important kind of power of all. The power to be your best.*

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*Some of these capabilities may require the purchase of additional software or hardware. **Don't believe us? Surf on over to http://www.apple.com to see the results of independent testing by Competitive Assessment Services. 1995. © 1995 Apple Computer, Inc. All rights reserved. Apple, the Apple logo, Macintosh and "The power to be your best" are registered trademarks of Apple Computer, Inc. Mac, Power Mac and Power Macintosh are trademarks of Apple Computer, Inc. PowerPC™ is a trademark of International Business Machines Corporation, used under license therefrom. "Where do you want to go today?" is a trademark of Microsoft Corporation. All Macintosh computers are designed to be accessible to individuals with disability.

Extreme 3D and Extreme FX

Macromedia (800-326-2128) will ship its first PC-based 3-D product for Windows 95 in October. Extreme 3D (and its bundled companion product, the postproduction tool Extreme FX) will use Win32s to support Windows 95, NT, and 3.1. It is also expected to be binary-compatible with its Macintosh counterpart.

Extreme 3D will employ a spline-based modeling engine, (using either primitives or vector lines) to create 3-D objects; every object, surface, and point can be animated. The product will also use score-based animation, similar to that found in the Macromedia Director multimedia authoring product.

In addition, Extreme 3D will support hierarchies, trimmed surfaces, and volumetric lighting. Though the interface will feature some tabbed dialogue boxes, the 32-bit application is not expected to receive the Windows-compliant logo; it lacks OLE 2.0 container and mail support. The product's anticipated list price is from $595 to $795.

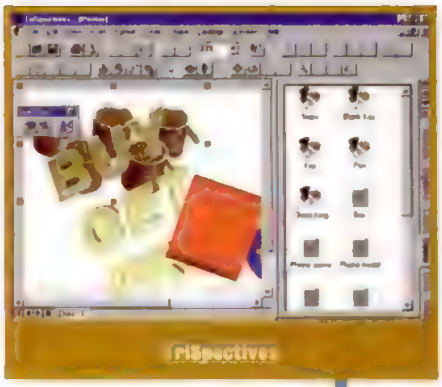
TriSpectives

Of the 3-D applications, TriSpectives, from 3D/EYE (800-946-9533, 607-257-1381), is one of the few developed specifically for Windows 95 (it also runs under Windows NT). This 3-D modeler/renderer/animator relies heavily on OLE embedding to create multilayered, or nested, documents filled with fully editable 3-D objects.

Images and animations are all built initially by dragging and dropping shapes, textures, and even boiler-plate movements from a series of catalogs located on the right side of the screen. The objects, known as IntelliShapes, have prebuilt intelligence so they know how to interact with the image and other shapes as well. 3D/EYE's SmartRender technology provides quick visual feedback on how the images will look as rendered 3-D objects. TriSpectives uses Windows 95's native multithreading capabilities to render a quick lower quality image first, while it renders the smoother one in the background. Built on a CAD-like engine, the simple object-creation tools belie TriSpectives' underlying complexity.

DesignCAD 3D 5.0 for Windows 95

You'll be able to create and modify an entire 3-D scene by using drag-and-drop objects, or you can modify minute details of each object through TriSpective's tabbed dialogue box (object properties can also be accessed via a right mouse button click). In addition to details regarding colors, textures, and position, you can dig down to the formulas for some of these object characteristics. This Windows-compliant Win32 app is expected to ship within 30 days of Windows 95 for a street price of $299.95.


TriSpectives

Instant 3D

Visual Software (800-669-7318), makers of Visual Reality and Simply 3D, previewed a Windows 95–native 3-D text application: Instant 3D. A prerelease version wasn't ready in time for this story, however.

The application (which will use Win32s to run under Windows 3.1) will let you create and edit 3-D text within Microsoft Office's Microsoft Word for Windows, with support for other suite environments to follow. Essentially an OLE client application, it uses OLE 2.0 seamlessly within Word once a link is created. The anticipated street price is $49, and it will ship within 30 days of Windows 95.—*Lance Ulanoff*

COMMUNICATIONS

You can bet on a flood of redesigned communications programs once Windows 95 ships, since its communications architecture is one of its most innovative features. At press time, however, only two established products were even in prerelease.

Qmodem Pro for Windows 95

Mustang Software (800-999-9619, 805-873-2500) has developed Qmodem Pro for Windows 95 so aggressively that the company plans to ship it on nearly the same day that Microsoft ships Win 95 itself (list price, $129).

Mustang's developers kept Qmodem's excellent

Drivers' Ed

CHAPTER 1:

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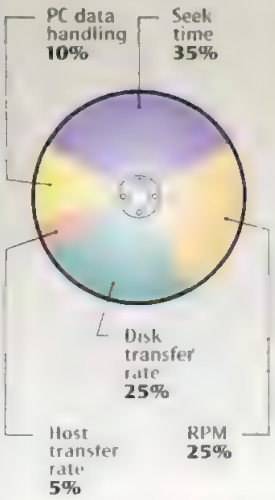

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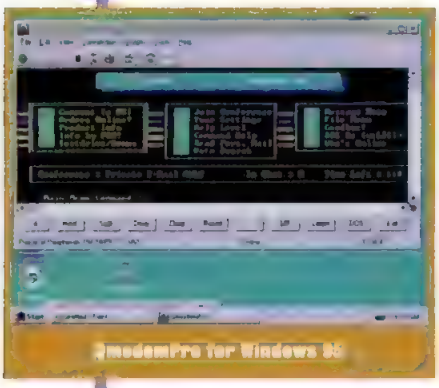
capacity for handling .BMP, .GIF, and JPEG images while integrating full OLE 2.0 drag-and-drop and other Foundation Class front-end features. The right mouse button delivers useful and diverse menus on different screens. The developers also hooked into the MAPI message transport so you can download files and then automatically send them directly across the local network to MAPI-enabled applications—including Microsoft Exchange.

The program has many dialing options. It works through TAPI, taking advantage of the Win 95 32-bit communications services, but you can address the serial ports directly. The dialer can automatically send credit card information and handle international calls. The company will also deliver nearly 40 terminal emulators in the package.



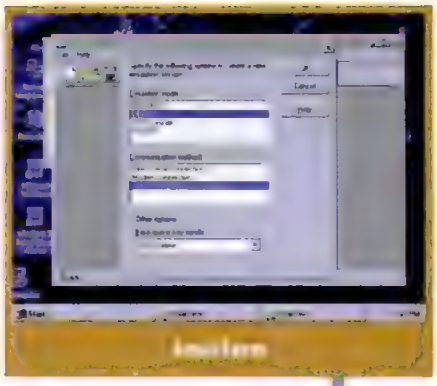
Other noteworthy features include the ability to search the scrollback buffer for specific text strings and a full uninstall option. Whether you're dialing BBS systems, connecting to mainframes, or telnetting to the Internet, Qmodem Pro for Windows 95 has excellent power and flexibility.

SmarTerm

The name of the game for Persoft (800-368-5283, 608-273-6000) is terminal emulation. If you run an accounting application on a VAX that uses 132 columns and double-high characters, you probably know about SmarTerm, Persoft's communications and terminal emulation program. The SmarTerm, 32-Bit Edition for Windows 95, due when Microsoft rolls out the operating system, keeps and enhances the Persoft SmarTerm tradition.

SmarTerm does a lot more than terminal emulation: The program also comes with viewers for 21 different file formats, a powerful scripting language, 32-bit editions of CompuServe B+, Xmodem, Ymodem, and Zmodem file transfer protocols and other features common to communications programs. You can use it to dial into a local BBS, but you're more likely to use it to work on corporate computer systems.

The major contribution of Win32 to SmarTerm is in improved multisession performance. The program is capable of running as many as 16 simultaneous sessions—handy if you're using a variety of applications running on different host computers. You can configure each session to use direct serial cable, modem, or network connections. The program has a full TAPI interface.



The Foundation Class Libraries and user interface let you do things like initiate file transfers using drag-and-drop, copy text from the scrollback buffer to points on the screen so you can recreate actions, and reconfigure the screen in practically any way you choose. The program includes various toolbars and allows you to remap your keyboard completely on a per-session basis so you can easily create user-defined special function keys. The prerelease version was quite smooth and intuitive.

Com Suite for Windows 95

Delrina Corp.'s (800-268-6082) Com Suite for Windows 95—scheduled for release 30 to 60 days after Win 95—will contain Win Fax Pro, Win Com Pro, and Cyberjack, a new subsuite of 32-bit Internet applications. Innovations will include fax on demand, RIP support, a ZIP manager with long-filename capability, and in-line antivirus protection.

Crosstalk for Windows 3.0

Attachmate Corp. (800-426-6283), the new owner of Crosstalk communications software, promises fourth-quarter delivery of Crosstalk for Windows, Version 3.0, which will include both 16- and 32-bit code in one package. The 32-bit version will be ready for Windows 95 and Windows NT and will improve Crosstalk's already capable multisession capabilities.

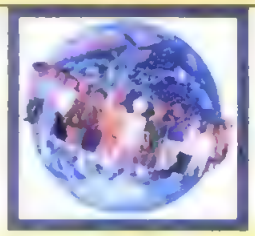
DataFax+

DataFax+ from Trio Information Systems (800-880-4400, 919-846-4990) has been better known for its fax than for its data capabilities, but that's about to change. In a new version, planned for release 90 days following the release of Windows 95 (list price for the single-user version, $129; for the multiuser version, $289), Trio expects to include features for cellular phone and voice communications. The new version will address TAPI for communications and interfaces like CMC, MAPI, MHS, and VIM for message handling on internal networks.

HOUR 1 > You've got 10 free hours on Prodigy. So naturally, you begin by exploring your lifelong fascination with SPAM® (a.k.a. "potted meat," "pink gold")

HOUR 2 > You jump on the Internet where you find out that Margaret Thatcher called SPAM "a wartime delicacy." (Then again, she likes English food.)

HOUR 3 > You discover SPAM poetry, SPAM sculpture and a dangerous number of people who named their children "SPAM."



HOUR 4 > You write a poem called "Man's Eternal Desire, for Paté Piglet Congealed by Fire," and email it to the SPAM SISTERS. They're so moved, they invite you to dinner.

HOUR 5 > You get on Chat and have long talks with several of the Spams including the notorious "SPAM SISTERS."

HOUR 7 > An Alaskan named Skut tells you that at 55 below, he likes to ride his snowmobile with a can of SPAM tied to the exhaust pipe until it's perfectly browned. You found a soul mate.

HOUR 8 > You learn that when you order a bottle of Dom Perignon at the Fly By Night Club in Juneau, Alaska, you get a free can of SPAM. (It should be the other way around.)

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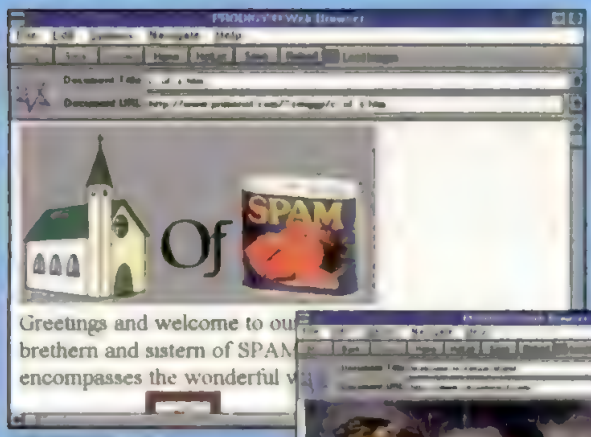
HOW TO GET INTO IT.



[illegible] we can't discuss in the presence of our Lord or our legal editors

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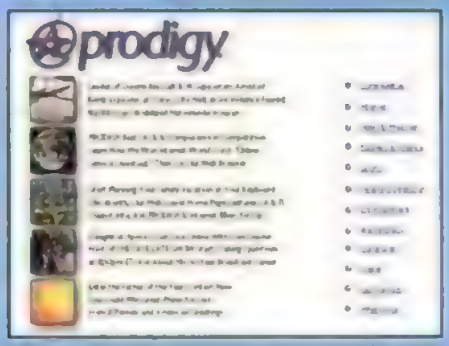

This is new. It's easy to look at, easy to read and ridiculously [illegible] Internet was like using a Rubik's cube?

If you can get this far into SPAM, imagine how easy it will be to learn about Brazil. Or research an investment. Or get into a world of other places the new Prodigy can take you.

[illegible]

We understand your insatiable thirst for SPAM trivia. You need it quickly. And you don't want to expend too many brain cells looking for it. **So we created a way to explore the Internet by organizing it for you.** In fact, in a recent comparison test at the spring Internet World show, we were unanimously voted the best for Internet access. (This is good.)

What a lovely face

It's like candy for your eyes. From the photo icons to the scrolling text to the tasteful new typeface. Not to mention its smooth integration with the Internet. Everything about the new Prodigy design makes it easy to get into.

What is it about you

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DynaComm Connectivity Suite

Both 16- and 32-bit versions of FutureSoft Engineering's DynaComm Connectivity Suite (800-989-8908) should be released in the fourth quarter of this year. The 32-bit version will be aimed at both the Windows 95 and Windows NT platforms.

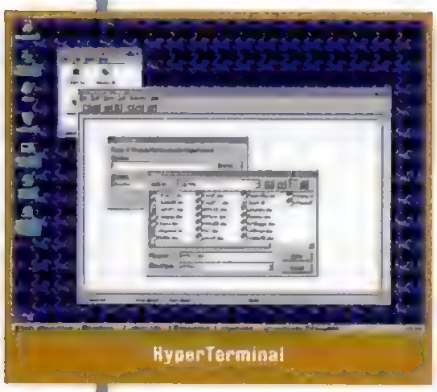
The major development in the 32-bit product will be the ability of different scripts running in separate synchronous and asynchronous sessions to interact. The company plans to use TAPI and other Win 95 communications services and to fully integrate OLE 2.0 and the features of the Foundation Class Libraries.

FaxTalk Messenger for Windows 95

In the past, Thought Communications (408-452-1010) has OEMed basic fax and voice technologies to other vendors (like Datastorm). The company now plans to release its own product, FaxTalk Messenger for Windows 95, before the end of the year. Features will include new fax-encoding routines for the T.6 standard, an error-correcting mode for faxes, and voice messaging with private voice, data, and fax mailboxes. The system will also have fax on demand and pager notification. FaxTalk Messenger can call MAPI and TAPI and will provide multiline and multisession operations.

HyperTerminal and HyperAccess

The clear leader in the development of 32-bit and native OS/2 communications programs has been Hilgraeve (800-826-2760). And the company is continuing its leadership role by shipping HyperTerminal with Win 95 as an applet. HyperTerminal is fully functional, and it lacks only scripting and advanced terminal emulation to be an all-inclusive program.


HyperTerminal

As far as concentrated Win 95 development efforts go, the folks at Hilgraeve say their primary Win 95 product will be a new release of HyperAccess for Windows, which should be ready before the end of the year. The new release will have a lot of code in common with the 32-bit HyperAccess Lite, which IBM bundles with its OS/2 Warp BonusPak. Like the HyperTerminal applet, it will take full advantage of Windows 95's communications services but will also include the scripting, terminal emulation, and flexibility features seen in Hilgraeve's other products.

Procomm Plus for Windows 95

A 32-bit version of ProComm Plus for Windows should roll out within 90 days of the launch of Windows 95. Beyond all the standard Win 95 features, the folks at Datastorm Technologies (800-315-3282, 314-443-3282) are also adding voice mail capability that will take full advantage of TAPI's services and a full suite of Internet tools including a Web browser. The new program will also be certified to run under OS/2 in the Windows emulation mode.

QuickLink III

Smith Micro Software (800-964-7674) will be adding voice capabilities to their products in upcoming releases: QuickLink III, planned as a Win16/Win32 package, is expected within three months of Windows 95's release and will incorporate voice mail and digital voice responses with its fax and data capabilities.—*Frank J. Derfler, Jr.*

DATABASES

For database software, the potential of Windows 95 is quite promising, primarily because of its ability to manipulate huge amounts of data in memory, though it will be some time before the products take full advantage of the possibilities.

Microsoft Access for Windows 95

On a mission to support a broad range of database users, from beginner to developer, Microsoft Access for Windows 95 (800-426-9600), which is shipping late in the fourth quarter, uses just about every feature in the Windows 95 book to enhance the various aspects of the program. For example, Microsoft Access has an impressive set of tools and Wizards for attacking the classic problem of a novice who is trying to create a relational database.

Microsoft Access for Windows 95

Based on the selection of a template (example databases), the Database Wizard creates tables and data access tools like screen forms and reports.

One such tool is the Performance Analyzer, which can be used on any database object to determine whether it is efficiently designed. These and other Wizards are both problem solvers and tutorials: They shortcut the intricacies of database design while teaching the user about the principles involved.

Compatibility and consistency with Microsoft Office, other priorities for Access, have been enhanced through extensive use of OLE and common components like spell-checker and autocorrect. The integration has come to a point at which dragging and dropping data between applications or using Excel's new geographic mapping tool within Access seem almost routine.

For the developer (and power user), an important new feature is the ability to replicate and synchronize databases. Together with the Windows 95 Briefcase component, Access modifies a standard database into a replica, so it can be copied to a remote location and kept synchronized with the original replica. Significantly, Access's databases now store forms, reports, and other items as objects, which are synchronized right along with the data. Replication is an intriguing example of how Access is exploiting the objects and components approach of Windows 95. At press time, pricing was unavailable.

Visual FoxPro 3.0 for Windows

Available since July, Microsoft's Visual FoxPro 3.0 for Windows (Professional Edition street price, $499; Standard Edition street price, $199; 800-426-9600) not only got on the Windows 95 bandwagon early, but in some ways helped pull it. As one of the first fully 32-bit programs, not only for Windows 95 but also for Windows 3.*x*, this version of FoxPro shows how the balance of power is shifting from the old to the new.

Alpha Five for Windows 95

Visual FoxPro 3.0 features a redesigned database system, which includes a data dictionary, database server capabilities, and enhanced SQL with updatable SQL views—these are the areas that are considered weak in FoxPro's old Xbase approach.

An even more dramatic change has occurred in the programming and applications development system: a nearly complete shift to object-oriented programming (OOP). The old FoxPro/Xbase commands are still available, but most programming will now be accomplished by object-oriented extensions to the language and a new development environment that includes such OOP amenities as a Class Designer and a Class Hierarchy Browser. FoxPro now uses forms, grids, and controls to create a user interface, supported by an OOP structure that is rigorous without being dogmatic.

Everything about Visual FoxPro 3.0, from the tabbed dialogs to the new menu system, reflects the look and feel of Windows 95. Older FoxPro programs are still compatible, however, and in many cases can be converted to the new look and feel. Any pretense that Visual FoxPro 3.0 is for the end user seems to have fallen by the wayside, for its strength is still being developed.

Alpha Five for Windows 95

In keeping with its tradition of providing a simplified user interface for a relatively powerful database manager, Alpha Software Corp.'s Alpha Five for Windows 95 (800-451-1018), shipping in the fourth quarter, will take advantage of long filenames, add a program manager that emulates the Windows 95 Explorer, and incorporate OLE 2.0 capabilities. Additions are also being made to the data management capability, including use of ODBC for connectivity to other database systems. At press time, pricing was unavailable.

askSam for Windows 95

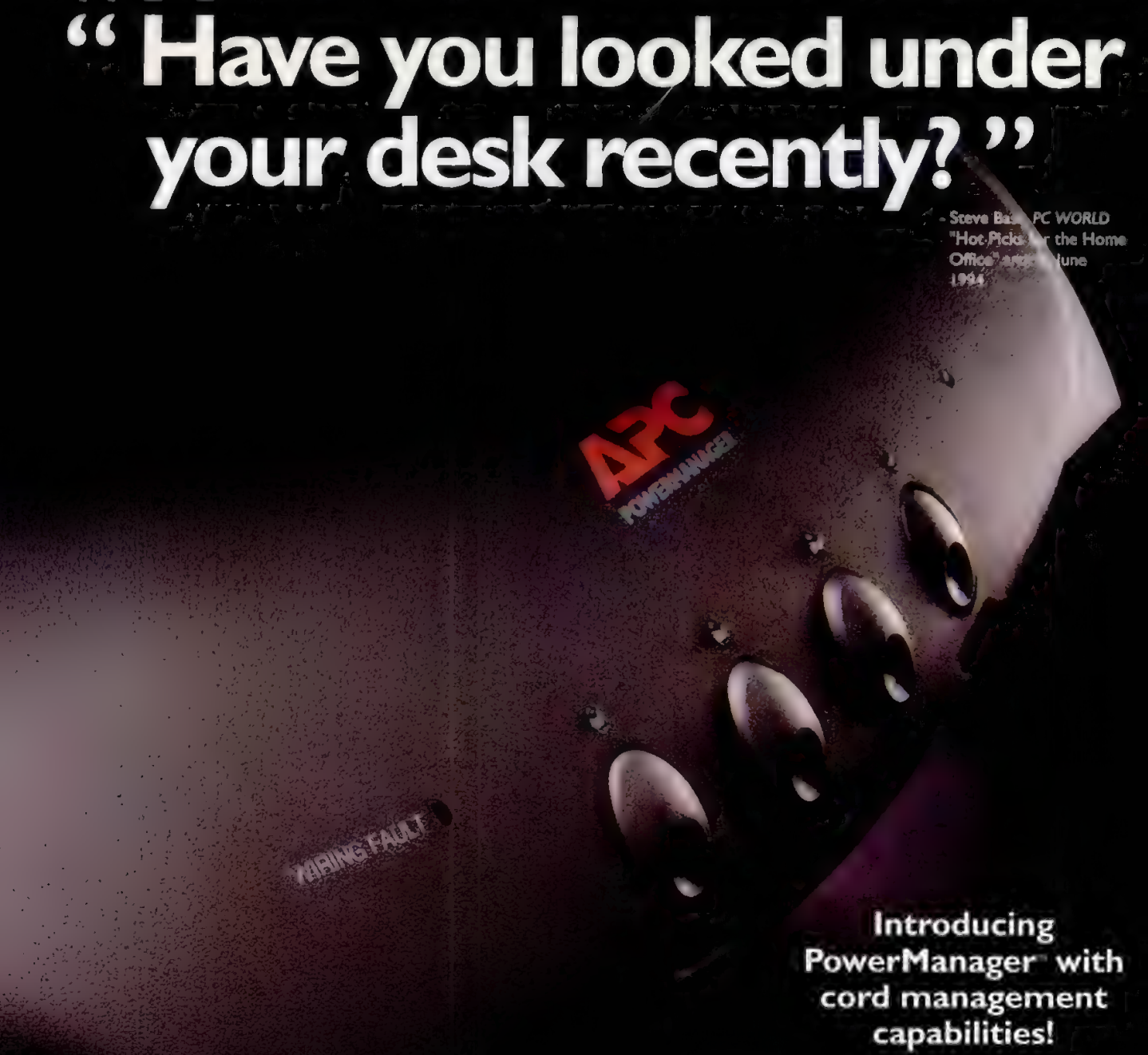
While retaining its focus as a free-form database manager, askSam Systems (800-800-1997) is going beyond the redesign of the askSam for Windows 95 user interface and has announced support for multithreading (simultaneously executing subprograms) for operations like searching, file loading, and printing. Along with a new Visual Basic–compatible language, OLE automation, and Windows 95 ease-of-use enhancements, askSam for Windows 95, with a release in the first half of 1996, adds up to a major new version.

FileMaker Pro 3.0 for Windows 95

As the next version of Claris Corp.'s FileMaker Pro 3.0 for Windows 95 (800-325-2747) undergoes the Windows 95 transformation, it will lose its status as one of the last remaining flat-file database managers. The aim of FileMaker Pro 3.0 will be to retain its simplicity and ease of use while offering the advantages of a relational database structure. This ver-

"Have you looked under your desk recently?"

- Steve Bass, PC WORLD "Hot Picks for the Home Office" article, June 1994



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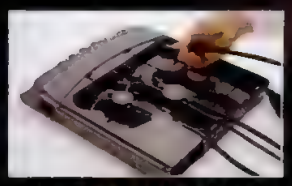

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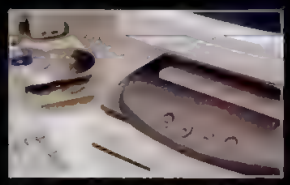

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sion of FileMaker Pro (due in the fourth quarter; pricing was unavailable at press time) will be a major upgrade.

With a target for shipping by the end of the year, Borland International's Paradox for Windows 95 (800-233-2444) will be fully 32-bit and designed for the Windows 95 look and feel. Paradox will include many more Experts and better integration with the other applications such as the Novell Perfect Office suite. It will also be extending its design to incorporate a degree of compatibility with Borland's hot Delphi applications development product. At press time, pricing was unavailable.

R:Base 5.5

With a pedigree going back to the earliest days of PC database software, Microrim's R:Base (800-248-2001, 206-649-9500) continues to change with the operating systems. It is getting a bit of a jump now: The current version, R:Base 5.1, is already a 32-bit program under all versions of Windows, including Windows 95. As a new release scheduled for later this year with a list price of $495, R:Base 5.5 will adopt the Windows 95 look and feel. —*Nelson King*

DESKTOP PUBLISHING

No software companies were able to deliver prerelease versions of their desktop publishing packages before our deadline, but several reported their development plans.

Corel Ventura 6

The Win 95–compliant version of Corel Corp.'s Corel Ventura 6 (800-772-6735, 613-728-8200) is scheduled to ship in November or December 1995. New features in this fully 32-bit package will include extensive HTML and SGML support for on-line publishing. At press time, pricing was unavailable.

FrameMaker

Frame Technologies' FrameMaker (800-843-7263, 408-433-3311) is already a Win32s product, so it will run on both Windows 3.1 and Windows 95. The company plans to produce a Win 95–compliant version but hasn't announced a time frame or price. An OS/2 version of the product should be available by the end of the year, however.

Microsoft Publisher

From Microsoft Corp. (800-426-9400), there's the Win 95–compliant Microsoft Publisher CD Deluxe for Windows 95 and Microsoft Publisher for Windows 95 (the floppy disk version), which at press time were slated for release in late September 1995. Each will sell for an introductory street price (lasting about 90 days) of $79.95. Microsoft will continue to sell and support the 16-bit version as well.

PageMaker 6.0

In the spring of this year, Adobe Systems. (800-833-6687, 415-961-4400) released PageMaker 5.0 for the first time as an Adobe product since the merger with Aldus Corp. in 1994. Version 5.0 is a 16-bit application that can run on both Windows 95 and Windows NT; it will be upgraded to a Windows 95–compliant version by October of this year for a list price of $895 (upgrades, $149).

PageMaker 6.0

This new version, PageMaker 6.0, will support the Kodak Precision Color Management System, multiple master pages, and PhotoCD. Other new features will include a table editor, object masking, OLE 2.0 client support, and the ability to convert files to Portable Document Format (.PDF). The package will also include an HTML Author Plug-in for creating HTML documents. Finally, PageMaker 6.0 will ship with the Win32s DLLs, so you will be able to run the package on Windows 3.1.

QuarkXPress 3.32 and 4.0

Representatives at Quark say that QuarkXPress won't be fully Windows 95–compliant until 1996. And though the current version, 3.31, isn't 32-bit, company representatives say there are plans to release a patch to make it Win 95–compatible. Quark says the 16-bit patch (Version 3.32) will ship concurrently with Win 95 for a list price of $895. But when ready, it will speed up printing under Win 95, according to the company. The next full upgrade of Quark XPress, Version 4.0, is expected to be fully compliant with Windows 95. The company hasn't yet announced an expected ship date or price for the upgrade.—*Kathleen Caster*

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Stop hunting for phone jacks! Make your laptop really portable with the Personal Messenger™ 100 Wireless Modem Card from Motorola. With this compact, easy-to-use card, you can send/receive E-mail from your office network or the Internet, send faxes, or access corporate databases, and more— free of phone lines. With the modem card and Motorola's AirMobile™ wireless software, laptop users with **Lotus® cc:Mail™ Mobile** for Windows® can directly access their corporate E-mail server to exchange messages and files over the ARDIS℠ nationwide wireless data network. It's a single mailbox solution to support mobile workforces, traveling executives and others who want to keep in contact from just about anywhere.* And, using the ARDIS network, there are no roaming or long-distance charges. To untether your laptop from phone lines forever, call for your nearest dealer and an information kit. And, for a limited time, take advantage of a special introductory rebate offer. Call our toll-free number for details.

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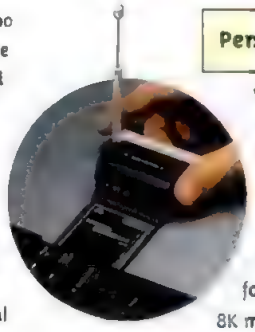

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CIRCLE 356 ON READER SERVICE CARD

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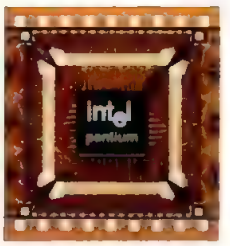

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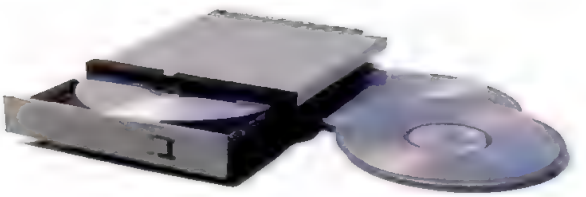

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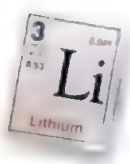

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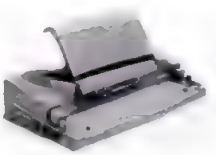

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CIRCLE 379 ON READER SERVICE CARD

DEVELOPMENT TOOLS

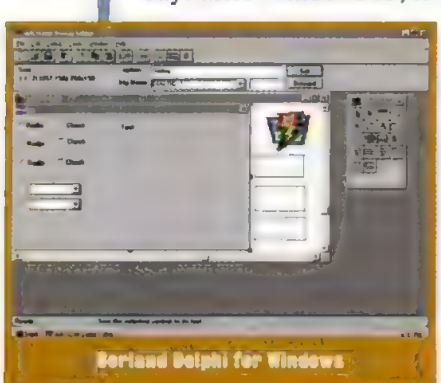
Software developers will be able to pick their favorite tools from a variety of 32-bit contenders. Most of the products we saw will be able to support 32-bit development on and for Windows 95 by the end of the year.

Borland C++ 5.0

Now in beta and targeted for release by the end of the year, Borland C++, Version 5.0, (from Borland International, 800-233-2444) will support both Win16 and Win32 development. New features include a new version of Borland's Object Windows Library, Version 3.0, which encapsulates common controls such as status bars. It will also offer compiler support for the Microsoft Foundation Classes. Borland aims to bring its C++ language implementation into virtually complete conformity with the ANSI standard. Applications created with Borland C++ can be OCX containers, but OCX server support will be added in a future release.

Borland Delphi for Windows

Currently a 16-bit system, a 32-bit version of Borland Delphi for Windows (from Borland International, 800-233-2444) is slated to be released 90 days after Windows 95; it will run on both Windows 95 and Windows NT. The product will also share a 32-bit compiler back end with Borland C++ and will include support for multithreading, OCX controls, and Windows 95 interface objects (for additional details on upcoming features, see the story "Visual Basic and Borland Delphi Head to Head").


Borland Delphi for Windows

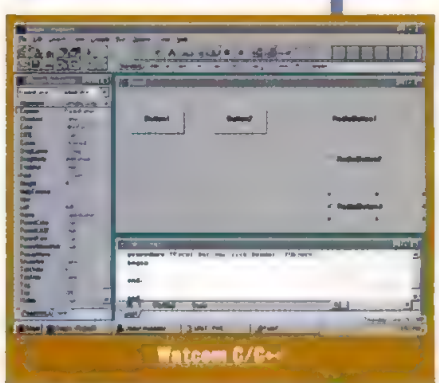
Gupta SQLWindows 5.0

By the end of the year, Gupta Corp.'s Gupta SQLWindows, Version 5.0, will see a major new release 90 days after Win 95 ships. The project, code-named Stinger, will support Windows 95 and Windows NT as both host and target. At press time, pricing was not available.

Microsoft Visual Basic 4.0

Microsoft Visual Basic, Version 4.0, which should be available from Microsoft Corp. (800-426-9400) by the time you read this, will run as a 32-bit tool and offer several new features designed to take advantage of the Windows 95 architecture.

Highlights include 11 new custom controls based on the new 32-bit OLE control format: SysInfo (for supporting plug-and-play capabilities), Tree View, List View, Image List, Status Bar, Progress Bar, Slider, Toolbar, Tab Dialog, Status Bar, and Rich Text. An install/uninstall capability is also included in the Setup Wizard. New data-aware controls include an editable grid, list box, combo box, and OLE control. You will also be able to create custom OLE automation objects, which can be called in other applications supporting OLE automation.


Watcom C/C++

The Professional Edition ($499) and Enterprise Edition ($999) will ship in 16- and 32-bit versions; the Enterprise Edition will support remote OLE servers. The Standard Edition ($99) will be 32-bit only.

Conditional compilation lets you write a single source file and compile it for multiple operating systems based on programmer-defined variables (for additional details on upcoming features, see the story "Visual Basic and Borland Delphi Head to Head").

Microsoft Visual C++ 2.1

Somewhat ahead of the curve, Microsoft Visual C++, Version 2.1, from Microsoft Corp. (800-426-9400; list price of $499, upgrade, $399) currently supports Windows 95 and Windows NT development. Features include support for Windows 95 common controls and a new version of Microsoft Foundation Class Libraries, Version 3.1.

New OLE 2.0 classes support in-place editing, copying and pasting of OLE objects, and drag-and-drop visual editing. You can build visual editing servers or containers. The new version lets you add classes that support OLE automation and add methods and properties to your own classes that support OLE automation. Class Wizard can create C++

classes for objects exposed by other automation servers.

Powersoft PowerBuilder 4.0.2

At Powersoft Corp., a minor upgrade, Version 4.0.2, in the works for mid-July, will enable Powersoft PowerBuilder, Version 4.0, to run as a 16-bit application under Windows 95. PowerBuilder 5.0, expected in the first quarter of 1996, will include major enhancements such as distributed objects, multitier architecture support, an object store, and a native-code compiler.

Object Studio 5.0

With an end-of-year target release date, VMark Software's Object Studio (800-625-3287), Version 5.0, will be 32-bit and support native multithreading, OLE (both client and server), OCX embedding, and OLE component creation.

Symantec C++ 7.0

Currently, Symantec C++, Version 7.0, from Symantec Corp. (800-441-7239, 503-441-7239; street price, $199) supports 32-bit as well as 16-bit development. In its C++ package, Symantec is shipping information about the Preview Version of the Windows 95 SDK along with an order form for a free copy of the product. The Preview Version contains Windows 95 headers, libraries, and samples, and the final SDK will be available after Windows 95 ships.

Symantec Enterprise Developer 2.0

Symantec Enterprise Developer, Version 2.0, from Symantec Corp. (800-441-7239, 503-441-7239), is scheduled for an update in mid-1996. This upgrade will feature a 32-bit GUI builder, and the rest of the product will still be 16-bit.

Visual Smalltalk Enterprise

Digitalk's Visual Smalltalk Enterprise (714-513-3000), Version 3.1, which will be released 90 days after Win 95 ships, supports Windows 95 and Windows NT development as both host and target. The 32-bit tool will also support OLE containers and OCX controls. At press time, pricing was unavailable.

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CIRCLE 007 ON READER SERVICE CARD

Watcom C/C++

By the time you read this, Watcom C/C++, Version 10.5, from Watcom International Corp. (800-265-4555; list price, $350, upgrade, $199) should be available; it supports Windows 95 and Windows NT as both host and target. Because it will ship before Windows 95, it will still include the header files and libraries necessary to take advantage of the beta Windows 95 interface in the box. When Windows 95 ships, Watcom will continue its Win 95 support. —*Elizabeth Holzer*

DIAGRAMMING

Publishers are introducing major enhancements to diagramming and flowcharting packages for Windows 95, including more sophisticated charting capabilities and improved integration with existing desktop applications.

ABC FlowCharter 6.0

ABC FlowCharter 6.0 from Micrografx (800-676-3110, 214-234-1769) will be a native Windows 95 application that is fully Windows 95– and Microsoft Office–compliant. ABC FlowCharter 6.0 will be fully 32-bit, but Micrografx won't offer Win32s or 16-bit versions.

The new ABC FlowCharter, of which we saw a prerelease version, will be included in a suite with two other Micrografx packages: Designer and Picture Publisher. The three components of ABC Graphics Suite will share a similar appearance, thanks mostly to their compliance with Microsoft Office.

The three Micrografx applications will share Binder support, OLE 2.0 automation (in ABC FlowCharter), and multithreading (in both Picture Publisher and Designer). And they will share the ABC Media Manager, which lets you organize and access images in one interface.

ABC FlowCharter 6.0

The suite will be available for an estimated street price of $299 and should ship 30 to 45 days after Windows 95.

Several changes have been made to ABC FlowCharter 6.0 itself. The package's DataAnalyzer, which was taken from the former ABC Toolkit and added to the previous version of ABC FlowCharter 6.0 for the first time, will include an improved spreadsheet that supports custom-labeled columns for each chart type.

Text search-and-replace capabilities, OLE 2.0 in-place editing, and new toolbars for preset styles and data fields are other additions to ABC FlowCharter. You can import shapes to many formats—including CorelDRAW, .EPS, and .WMF—and export charts to different formats—including .CGM, .DRW, .DXF, and .EPS.

ClarisImpact 2.0

New from Claris Corp. is ClarisImpact 2.0 (800-544-8554, 408-987-7000), a diagramming tool that lets you create not only flowcharts and organizational charts but also calendars, timelines, data charts, and outlines. We looked at a prerelease version, which is a 32-bit application that works under Windows 95. The package lets you create presentations and also supports cross-platform compatibility between Macintosh and Windows versions. The Macintosh, Power Macintosh, and Windows versions should be available by the time you read this.

ClarisImpact 2.0

New in this version is the DataDraw feature, which lets you import comma- or tab-delimited files to create business charts and graphs, outlines, and more. You can also apply premade or customized styles to tables and charts.

Visio 4.0

We looked at a prerelease version of Visio 4.0 from Visio Corp. (800-446-3335, 206-521-4500). The package will be fully Win 95–compliant and should be available by the time you read this.

Visio 4.0, besides meeting the criteria that is needed to be stamped with the Windows 95 logo, will support such Windows 95 offerings as QuickView and Scraps. QuickView lets you click on the icon of a file to view it. Scraps let you select anything in your file, drag the selection to the desktop (which acts as an OLE 2.0 container), and drag the selection into any application that supports OLE 2.0. And by right-clicking on any item, you call up context-sensitive menus. There will also be support

for the Binder (in Microsoft Office for Windows 95), which lets you organize document pages from multiple applications.

In addition, Visio 4.0 will support the interfaces of Lotus SmartSuite, Microsoft Office, and Novell PerfectOffice. It will also integrate with Lotus Notes.

New to Visio 4.0 is the ability to dock or float multiple stencils; you can also have the stencils appear tiled or cascaded. Stencils now appear automatically with any given file (previously, you had to find and open the stencils you needed each time you opened a file).

Wizards automate page layout and SmartShape manipulation in the new version of Visio. There are also wizards for creating time lines and organization charts.

With the new Mind Map diagram, you can start off with a drawing that looks like a brain and add branched lines stemming from the center. The Perspective Block is yet another new type of diagram.

The new SmartLayers feature lets you categorize shapes according to such criteria as Visible, Print, Active, Lock, Snap, Glue, and Color. In this manner, you can hide, color, or print certain shapes. You can create new layers as well. There's also a new freeform drawing tool based on spline technology, and new Boolean operators—Fragment, Union, Combine, Intersect, and Subtract—for manipulating shapes.

Visio will ship a 16-bit version of the package along with the 32-bit version. The new features that are specific to Windows 95 will be included in the 16-bit version as well.

allClear for Windows

In other product developments, a Windows 95 version of allClear for Windows from Clear Software (800-338-1759, 617-965-6755) should be available in the first quarter of 1996.

Adobe IntelliDraw

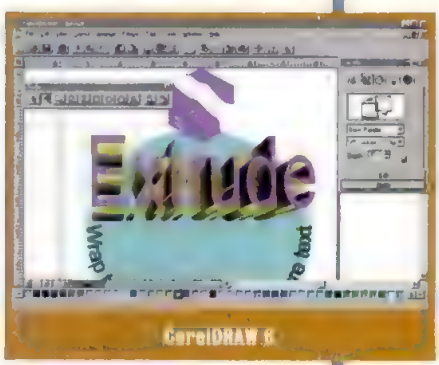
Adobe IntelliDraw from Adobe Systems (800-833-6687, 415-961-4400) will be released in a Windows 95–compliant version in the first quarter of 1996.
—*Kathleen Caster*

ILLUSTRATION

Corel continues to lead the pack with native Windows 95 applications and will usher in the age of the graphics suite. Several other illustration vendors also have Windows 95 applications in the works.

CorelDRAW 6

Corel Corp. (800-772-6735, 613-728-8200) has plans to port all its graphics software to Windows 95, in one suite that will ship concurrently with Windows 95. CorelDRAW 6 will include four applications: CorelDraw, the vector-based illustration tool; Corel PhotoPaint, for photo illustration and 24-bit paint applications; Corel Presents, a business and multimedia presentation tool; and CorelDream 3D, a 3-D modeling and rendering application. The last is based on RayDream Designer. The main enhancement of the original application is the new Windows 95 interface. One nice touch is the Modeling Wizard, which takes you step by step though the somewhat complicated process of extruding, lathing, and adding texture to an object. On the other hand, the application is among those that are the least integrated into the Corel suite.



CorelPresents is also new and represents Corel's first real attempt to challenge the more established presentation software players such as Lotus Freelance and Microsoft PowerPoint. As such, it will include import filters for Freelance and PowerPoint.

Corel has also decided to remove Corel Ventura, which was bundled in former Corel suites, and release an updated standalone version, Corel Ventura 6.0, in November. Among the major enhancements will be the addition of SGML and HTML capabilities.

The preview of CorelDRAW 6 for Win 95 revealed a highly customizable interface, e-mail capabilities, and other features necessary to receive the Windows-compliant logo. Other logo-related feature enhancements include long filenames and OLE container/server support with drag-and-drop.

Corel has made many significant Windows 95–related feature enhancements and additions to CorelDRAW 6, including better interface consistency

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across all the applications included in CorelDRAW 6, faster output and redraw, and multithreading.

The illustration portion of CorelDRAW 6 also has a few new drawing tools such as panning, knife, erase, and spiral tools. The erase tool, in particular, is notable since its inclusion in a vector-based tool is unusual.

Photo–Paint 6 has new filters, local undo and an undo list, editable text, and animation editing (rotoscoping). Pricing hasn't been announced for the application, which should ship shortly after Windows 95.

Macromedia FreeHand 5.0

The vector-based illustration tool, FreeHand, has wiggled through the merger (read acquisition) of Adobe Systems and Aldus Corp. to re-emerge in the hands of graphics and multimedia maven Macromedia (800-989-3762). We looked at a preview of the first version, 5.0, from Macromedia (it bought Altsys Corp., the original creators of Freehand). A Win32s application, FreeHand 5.0 will run on Windows 95 and Windows

Fun and Games in Win 95

By Gayle C. Ehrenman and Michael Ryan

Windows has always been something of a four-letter word for gamers, which explains why the big-ticket games have generally run only under DOS. Windows 95 may just change all that, by giving gamers the graphics power and speed they have long craved.

The biggest step toward turning Windows into an important gaming platform comes not from Windows 95 itself, but from a game-software developers' kit that provides game developers with a series of application programming interfaces (APIs) for creating fast-paced, graphically intensive games of the sort previously seen in the DOS and console gaming worlds. These APIs include: DirectDraw, which allows developers to communicate easily with display hardware; DirectSound, which provides for high-fidelity, low-latency sound and sound mixing; DirectPlay, which enables simple multiplayer game connectivity; and DirectInput, which provides support for digital joysticks and next-generation input devices. Of course, end users will never see these APIs, but they will receive pieces of them delivered as run-times with their Windows 95 games.

In Putt-Putt Saves the Zoo, the talking car and his loyal dog, Pep, must help find a series of missing baby animals so the zoo can open. As with previous Putt-Putt games, this one combines vivid animation, games, and puzzlesolving.

But what does it all mean for Windows game enthusiasts? Faster graphics and animation display, more realistic sound effects, more remote multiplayer gaming, and better calibration and control over joysticks, flight yokes, virtual reality headsets—and whatever else comes along.

There are also some features of Windows 95 proper that will appeal to gamers of all ages, but especially those under the age of 12. The most important of these are AutoPlay, AutoSetup, and automatic hardware detection. What this means is that your average 5-year old can drop a CD-ROM in the tray and start interacting with her favorite character with no help from you. And because most Windows 95 games will take advantage of the zero or low footprint capability, when you remove the CD-ROM from its caddie, you won't be left with 40MB of animations on your hard disk.

WHO'S CLIMBING ABOARD

Edutainment and kids' software developers are taking a cautious approach to Windows 95. Only two companies, Edmark Corp. and Humongous

Video-game favorite Bubsy the Bobcat makes his desktop debut in Super Bubsy for Windows 95, an arcade game that promises fast-paced action and nonviolent fun. Bubsy must save Earth (and its supply of yarn) from the Woolies

Entertainment have announced Windows 95 titles. By early fall, Edmark expects to ship Windows 95 versions of four of its current titles. Humongous will have 10 Windows 95 titles available by December, including the currently shipping Freddi Fish and the Case of the Missing Kelp Seeds, Putt Putt Goes to the Moon, Putt Putt Joins the Parade, Fatty Bear's Birthday Surprise, and the Putt Putt and Fatty Bear Activity Packs.

MindScape is the most active developer of games for grown-ups. Among their Windows 95 titles under development are: Al Unser Jr. Arcade Racing, ChessMaster 4000, Metal Marines CD-ROM, and USS Ticonderoga, all of which are due in September; NCAA Football and Campaign '96: The Doonesbury Election Game in October; and Warhammer and Pool Shark in November.

3.1. It should be shipping by the time you read this, for a list price of $595.

FreeHand's interface has remained largely unchanged since the last version, but FreeHand 5.0 adds an Operations tool box, which contains more than 12 customizable effects that would be more complicated if created manually. The Punch tool, for example, automates the process of knocking a hole through one layer, so you can view the object behind or under it.

Other improvements include the ability to view individual layers as keylines, multicolored fills, and almost unlimited zoom.

FreeHand 5.0 also features an open architecture that will allow third-party vendors to write what are known as Xtras for the application. HSC has added an extension, Vector Effects, a vector-based, special effects plug-in for FreeHand 5.0. It's expected to ship by the end of the year. FreeHand 5.0 won't carry the Windows-compliant logo, for it lacks OLE support and right mouse button functionality.

Other developers who've announced Windows 95 titles include: Activision (Pitfall: The Mayan Adventure); Accolade (Super Bubsy for Windows 95); Microsoft (Bookshelf, Cinemania 96, Microsoft World Atlas, Microsoft Dogs, Fury^3 and Return of Arcade); Spectrum HoloByte (Star Trek Generations and Falcon 4.0); 7th Level (Battle Beast); GT Interactive (Ice & Fire); and The Graphix Zone (The Improv Presents Windows 95 for the Technically Challenged). All of the games Origin Systems releases after January 1996 will be Windows 95 titles.

INVESTMENT PROTECTION

But all these APIs and titles will affect games currently in progress, so what about the hundreds of dollars worth of DOS-based software gamers already own? As it turns out, Windows 95 brings good news on this front, because it lets you run DOS-based games in a variety of ways.

The easiest way is to run a DOS game is from the MS-DOS prompt. We tested over 40 popular gaming titles with Windows 95 and got about half, including id Software's Heretic, Interplay's Descent, and LucasArts' Full Throttle, to run in this way. Each of these titles ran just as fast as they ran under DOS.

Microsoft's first venture into the action-arcade genre is Fury3, a futuristic first-person combat game. To succeed, you'll have to complete combat and rescue missions while saving eight planets from destruction.

To get a game running from the MS-DOS prompt, you may need to tweak a few settings. First and foremost, you should run the game in full-screen mode. Next, you might want to disable the read-ahead caching on your CD-ROM drive, since most DOS games have their own caching routines. Your CD-ROM reads might be slower, but we found that for many games the Windows 95 caching caused skipping when voice and music were being played from the CD-ROM.

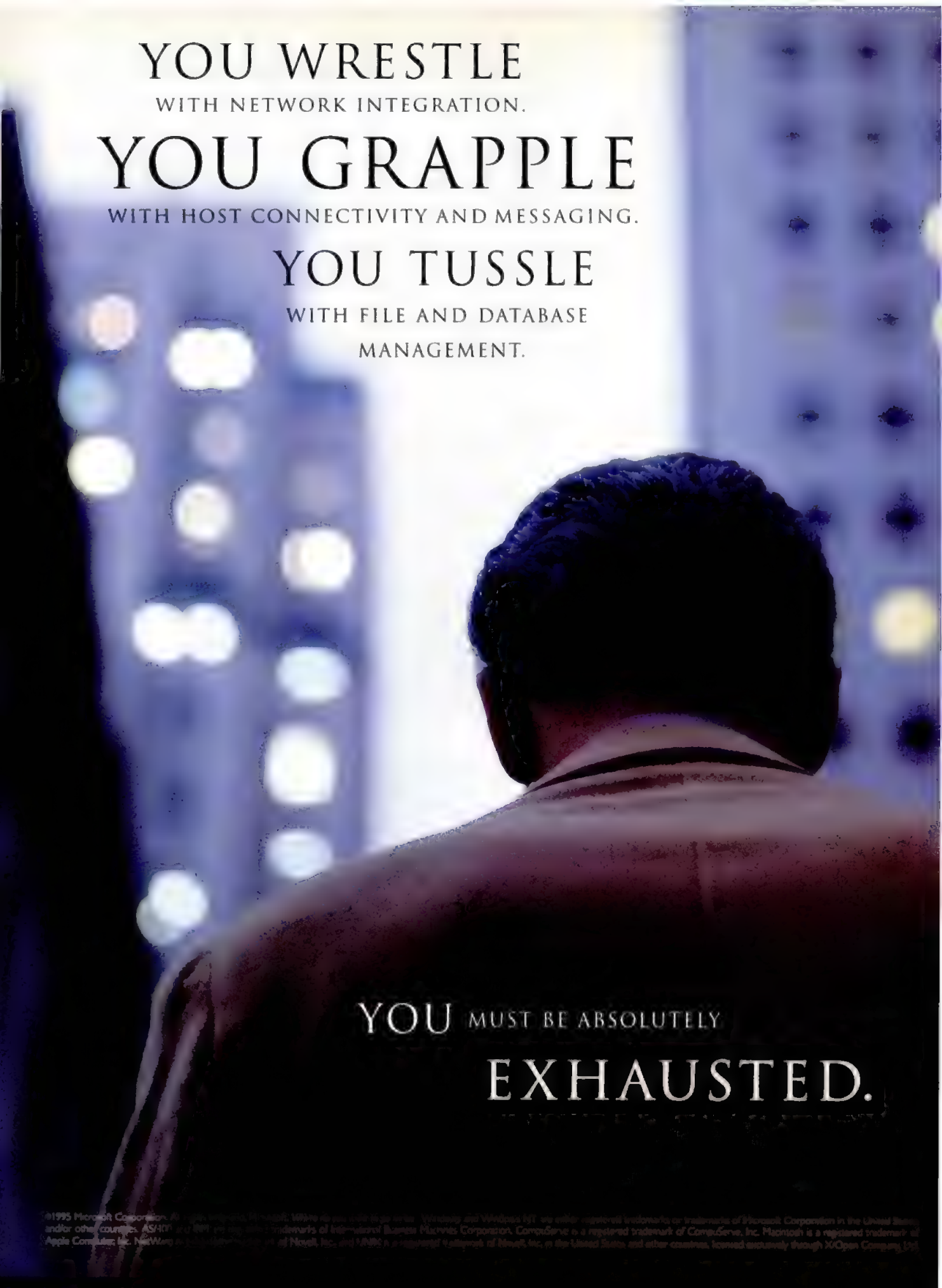
Also, you'll want to change a few of the Properties for the MS-DOS prompt, or the Shortcut you use to run the game. For the most part, you can leave the Memory settings on *Auto*. Under the Misc tab, however, make sure to deactivate the "Allow screen saver" option (under Foreground), activate the "Always suspend" option (under Background), and slide the Idle Sensitivity bar to *Low*. Finally, under the Program tab, click the Advanced button and activate the "Prevent MS-DOS-based programs from detecting Windows" option.

If you try all of these settings and your game still won't run under Windows 95, don't despair. You can still run it in *MS-DOS mode*, which has its good and bad points. The good news is that we have yet to find a DOS-based game that will not run in MS-DOS mode. The even better news is that for

Bungee, swing, and pit-hop along with Pitfall Harry, Jr., as he tries to rescue his father from an evil Mayan warrior in Activision's Pitfall: The Mayan Adventure. The Windows 95 continuation of the ever-popular Pitfall! series.

each game run in MS-DOS mode, you can specify a different AUTOEXEC.BAT and CONFIG.SYS file. If you're one of the many gamers that keeps a mile-high stack of boot disks near your PC, this feature alone may get you to install Windows 95. The bad news is that to launch the game in MS-DOS mode, Windows 95 reboots your machine using the startup files you specify, so all other applications are shut down. When you exit the game, your PC will reboot again, taking you back into Windows 95.

If neither of these options seems appealing, try hitting F4 while your PC is booting up to bypass Windows 95 and load your previous DOS configuration instead. Keep in mind that several key DOS files (like MSCDEX .EXE) are moved or deleted during the Windows 95 installation so you'll either have to copy them back onto your hard drive or change your PATH settings to include the WINDOWS\COMMAND directory where several of them have taken up residence. □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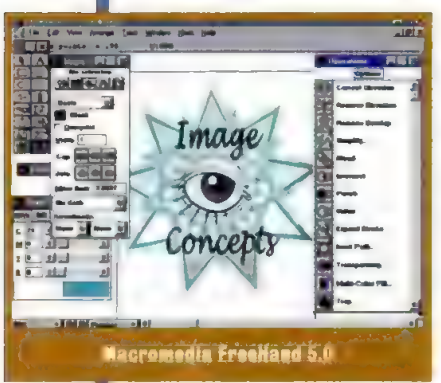
Designer 6.0

Micrografx (214-234-1769) will also be ready with a Win 95–native version of its more technical vector-based illustration package, Designer 6.0 within 30 days of Windows 95's ship date. This application is expected to be fully Windows 95–compliant, supporting OLE, mail integration, and right mouse functionality. Designer 6.0, like the rest of Micrografx's 32-bit application upgrades, will be sold only as a part of the new ABC Graphics Suite (estimated street price, $299).



Designer 6.0 does not add any major features beyond what is already found in Version 4.1. But like other Micrografx applications, Designer 6.0 has adopted a consistent Microsoft Office look and feel, including dockable, customizable toolbars.

Designer also integrates with the new Binder tool found under Microsoft Office 95. More or less a superset of OLE 2.0, Binder support lets Designer users incorporate their files into larger, multifile Binder documents. One of Binder's benefits over standard OLE is multiple-page support. Binder also manages page numbers across multiple-document files. Win 95's Scrap and QuickView features will be supported, too.

Adobe Illustrator

Adobe Systems' vector-based drawing tool, Abobe Illustrator, has not been upgraded significantly since 1992. Adobe (800-833-6687, 415-961-4400) has announced plans to release it as a Win 95–compatible application 30 days after the operating system ships.

Canvas

Canvas, long considered a more technical drawing application, has recently undergone a transformation. Denaba Software (305-596-5644) has added a host of new features and reams of clip art in an effort to compete more closely with CorelDRAW. Now Denaba is poised to introduce a 32-bit Windows NT version of the application. A Windows 95–native version should be available by the time you read this.—*Lance Ulanoff*

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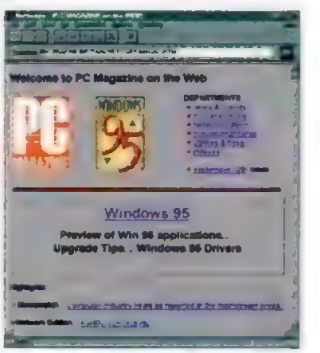

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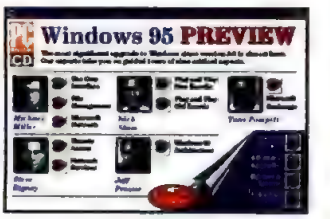

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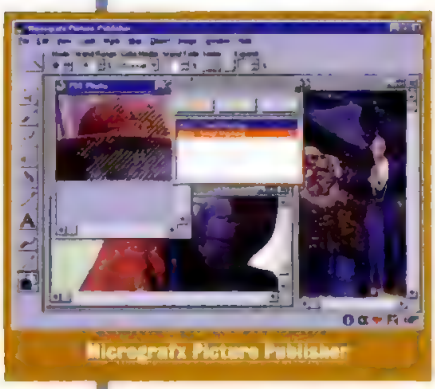
PHOTO ILLUSTRATION

All was surprisingly quiet on the image editing/24-bit paint front. Windows 95 may appear attractive to some vendors, but it may be that the native multiple processor support found under Windows NT could ultimately better suit the photo illustration vendor's tastes.

Micrografx Picture Publisher

The only photo-illustration tool ready for us to preview was Micrografx Picture Publisher from Micrografx (800-676-3110, 214-234-1769); this product also happens to be one of the few to use Windows 95 multithreading capabilities. Although the interface and features haven't changed significantly since Release 5.0, Picture Publisher, Version 6.0, for Windows 95 can take large, multiple image-processing routines, queue them up, and process them concurrently in the background. And you can track the progress of these multiple, spawned processes in Picture Publisher's Image Task Manager where each task appears as a different colored bar that grows as the process is completed.

As a Windows 95–compliant application, Picture Publisher features OLE 2.0 drag-and-drop as well as server capabilities. In addition, it also supports the much-touted long filenames and includes MAPI mail-send support. Picture Publisher is a pure 32-bit code application, and support for Windows 3.1 will not be included in this new version of the application.


Micrografx Picture Publisher

Picture Publisher will ship approximately 30 days after Windows 95 as part of Micrografx's new ABC Graphics Suite (street price, $299; competitive upgrades, $149). The suite will include Picture Publisher, Designer, ABC FlowCharter, SnapGraphics, and ABC Media Manager. The entire suite is Microsoft Office compatible and has adopted the office look and feel. This includes dockable, and customizable toolbars, as well as in-place OLE object editing.

Adobe Photoshop for Windows 3.0.4

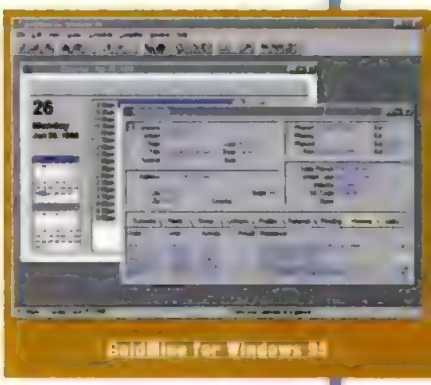
Adobe Systems' Adobe Photoshop 3.0.4 for Windows (list price, $895; 800-833-6687, 415-961-4400) is already a Win32s application and as such runs under Windows 95, Win NT, or Win 3.1. Version 3.0.4, which will be available by the time you read this, will help optimize Photoshop's performance under Windows 95. In addition, it adds right-mouse button support, long file names, and improved support for 16-bit plug-ins. A native Windows 95 revision is expected within 30 to 90 days after Windows 95 ships (price to be announced).—*Lance Ulanoff*

PIMS & CONTACT MANAGERS

Personal information managers (PIMS) and contact managers promise to be among the most active product areas for Windows 95, as vendors scramble to use its enhanced connectivity (like OLE and drag-and-drop) with other Windows 95 applications.

GoldMine for Windows 95

ELAN Software Corp.'s GoldMine for Windows 95 (1-800-654-3526) is a contact management and sales automation program noted for its large number of network-based features, such as a shared database, group scheduling, and network messaging. Snappy performance has always been one of GoldMine's characteristics, which the 32-bit version promises to enhance for both the user interface and network capabilities.


GoldMine for Windows 95

Although the current version of GoldMine was designed with Windows 95 in mind, the new 32-bit version will extend some of the approaches; for example, the use of tabbed dialogs, which look and work like tabs on a notebook. No doubt we will become jaded about tabs, but in GoldMine they can help you neatly organize

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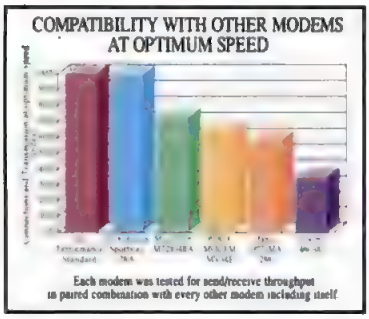

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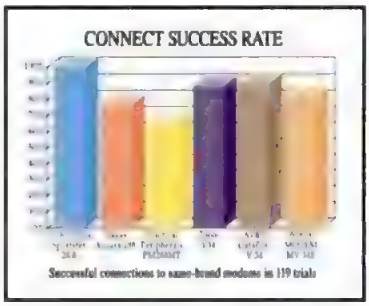
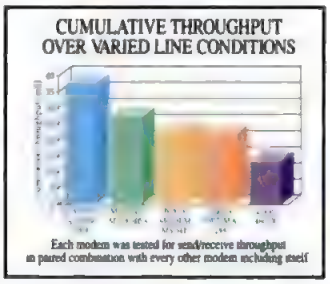
Any modem can enhance its connection rate by reducing speed. So the labs compared the modems' success at connecting at optimum rated speeds over a spectrum of line conditions.



Sportster outperformed them all. The differences were dramatic, with some brands connecting only 40% as often.

SPORTSTER TOPS IN THROUGHPUT, TOO.

Finally, the test labs compared which modems transmitted the most data under the widest array of line conditions. Once again, U.S. Robotics' Sportster came in first, delivering up to 177% more data.



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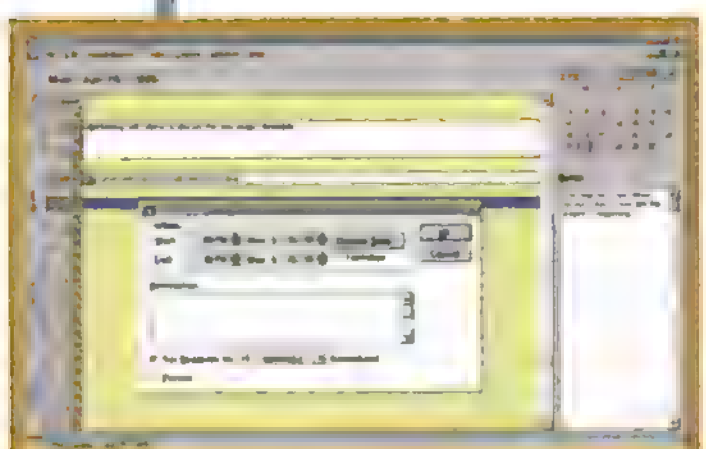
the constellation of information surrounding a contact. Instead of wandering up and down menus, you simply click tabs with obvious labels like History, Notes, and Summary.

GoldMine is also exploring Microsoft's Wizards technique to help users with conceptually difficult procedures. For example, the new Group Builder Wizard helps you define groups—lists of people or events used in reports, mailings, or phone calling. Because GoldMine can define groups with several different methods (search results, filter criteria, completed history, and profiles), the Wizard helps explain the choices, making the whole process more clear and useful.

GoldMine for Windows 95 isn't a major makeover of the current version, but it does exploit some of the capabilities in Windows 95 that most complement its approach to contact management. It is scheduled to ship 30 to 90 days following Windows 95, and at press time, pricing was unavailable.

Now Up-to-Date

As a crossover from the Macintosh to Windows PIM category, Now Software's Now Up-to-Date (street price, $99; 800-275-1669) will be one of the first Win 95 products to run on two platforms and share data over a network. It is scheduled to ship within 30 to 60 days of Windows 95. Network capability will be one of the highlights of this product, which features sophisticated group scheduling and data-sharing tools. For example, it automatically finds the best meeting time among groups of networked users and makes extensive use of Windows 95 e-mail (MAPI) to coordinate the event. Now Up-to-Date is also distinguished by a robust ODBC-compliant database system (the Watcom database engine), which is platform-independent and provides database synchronization for remote and portable computers.


Now Up-to-Date

Because this is a new product for Windows, Now Software has been able to design the product around the Windows 95 conventions and makes elegant use of tab dialogs, toolbars, and other user interface features. It also takes full advantage of the many Windows 95 built-in services such as TAPI for phone dialing, integration with word processing and faxing, and the ability to include documents from other applications through the use of OLE 2.0. Already well regarded on the Macintosh, this is a strong new entry among Win 95 PIMs.

Microsoft Schedule+ for Windows 95

The *plus* in Microsoft Schedule+ for Windows 95 (included with Microsoft Office for Windows 95; street price, $99.95, with upgrades from Version 1.0 for $79.95; 800-426-9600) seems to be the tail that wags the dog: The group scheduling and personal calendar are still highlights, but Microsoft Corp. has added many new functions and Windows 95 capabilities that make Schedule+ a complete PIM.

The new features include a sturdy contact manager with a contact database, business card view, and automatic telephone dialing. Also new is the To-Do List (task management) feature that includes a daily to-do list, task filtering, custom task fields, and a project-oriented task outliner.

As might be expected, Microsoft maximizes deployment of its Windows 95 features, which include drag-and-drop for tasks and activities, OLE automation, complete compatibility with Microsoft Office for Windows 95, and a redesigned interface with a full Win 95 look and feel.

Of special interest are Schedule+'s innovative new Wizards, such as Meeting Wizard (unusual for its sophisticated handling of group schedules), Answer Wizard, and Timex Watch Wizard. Schedule+ also incorporates principles from the well-known Stephen Covey book, "The Seven Habits of Highly Effective People," with view tabs and animated graphics drawn from a person's actual schedule.

Although Microsoft prefers to call Schedule+ for Windows 95 a time management product, it now has all the features of a complete PIM—combined with a bevy of Windows 95 capabilities. These will make it a formidable new competitor when it ships, about 30 days after Win 95.

Action Plus Contact Suite 2.0

Action Plus Software (800-766-7229) is revamping its sales automation contact manager into Action Plus Contact Suite 2.0, scheduled to ship 30 to 60 days after Win 95 for a list price of $395. The changes include not only a reworking of the user interface into Windows 95 conventions, but also a host of major enhancements: connection to all major e-mail software, faxing capability, a new feature called Time Maps for simultaneous graphical viewing of multiple schedules, and the ability to create named groups of contacts (called Dynamic Grouping). Also new is a database synchronization module called Satellite for Windows that links mobile workers to the office. Last but not least, order taking and accounting continues to be a strong suit with the introduction of a new Inventory Tracking module.

CrossTies 3.0

In keeping with two major trends for Win 95, CrossTies 3.0 (from CrossTies Software Corp.; 800-955-8437) is positioned as the object-oriented, document-centric PIM. A new Object Manager will integrate with the Win 95 desktop like a utility window. Just as you can organize and manipulate files in the Explorer, the Object Manager allows you to view and act on people, events, and projects as objects in an outline. Dragging a file from the desktop to a CrossTies object (like a meeting) is just like dragging files between folders in the Explorer. CrossTies also exploits other Windows 95 capabilities, such as the Briefcase to synchronize CrossTies objects on two computers. The product is scheduled to ship 30 to 60 days after Windows 95 for a street price of $99.

Janna Contact 95

Although the previous version of Janna Contact from Janna Systems (800-268-6107) was already close to a Windows 95 product, the new version (shipping concurrently with Windows 95 for a list price of about $99) will complete the transition to a document-centric approach for contact management. This includes the ability to drag-and-drop documents from anywhere into Janna Contact's Document Manager and to use OLE 2.0 in-place editing with almost any kind of information. The capabilities extend to a new integrated task list for drag-and-drop of items between lists. Most intriguing is a new feature available on CD ROM that will supplement the Windows 95 interface with voice and image capabilities—something Janna is calling a social interface for contact management.

Maximizer 3.0 for Windows

Maximizer 3.0 for Windows from Modatech Systems International (800-804-6299) is a list-oriented contact manager for individuals or workgroups with a current version that was designed with Win 95 in mind. It already features the Win 95 look and feel, support for OLE 2.0, and standard Windows e-mail support, and it uses TAPI for telephone services. Modatech Systems intends to release a 32-bit version of Maximizer 3.0 before the end of the year for a street price of $149.

Sidekick 95

The newest incarnation of one of the oldest PIMs, Sidekick 95 from Starfish Software (800-765-7839), shipping concurrently with Windows 95, will feature not only the standard Windows 95 enhancements to the user interface but also add complete support for TAPI, the Windows telephony interface, and the Windows 95 fax server. Other improvements include a rich-text document editor (with spell-checker), a personal expense tracker, and an Earthtime view of world time.

WinSales 3.0

Although WinSales 3.0 from WinSales (206-747-2464) was released before Windows 95—the 32-bit version will be available 30 days after Windows 95 (street price, $495)—it already represented a major redesign for Windows 95 compliance. In fact, this version jettisoned standard toolbars and adopted the Windows 95 tabbed dialog as its primary user interface. It adds connections with MAPI e-mail systems and OLE 2.0 capability. As a sales-automation contact manager, WinSales' biggest advance is its new add-on, Event Triggers, an advanced scripting language with a sequence of responses to e-mail, phone calls, and other sales contacts events.—*Nelson King*

PRESENTATION GRAPHICS

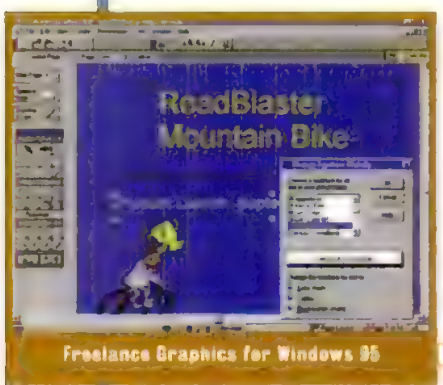
Presentations graphics packages get easier to use all the time, and the Windows 95 developments from Lotus, Microsoft, and SPC are no exception. The newest features ease presentation design and team collaboration.

Freelance Graphics for Windows 95

With an emphasis on what Lotus Development Corp. (800-343-5414, 617-577-8500) has termed Team Computing, Freelance Graphics for Windows 95 is expected to be ready by the fall of this year. At press time, pricing for this native, fully 32-bit version of Freelance Graphics was still to be determined.

The new Freelance Graphics will include numerous new Team Computing features. With the TeamReview feature, for example, you can distribute a presentation via floppy disks, e-mail at-

tachment or routing, a public directory posting, or a Notes database. The Team Review feature also allows your coworkers to add text comments, circle items, and add arrows to a document. Quick Comments, which you can add with the touch of an icon, include such remarks as "misspelling" and "punctuation error." All reviewer marks are color-coded by person so the marks are easily identifiable. You can allow reviewers to view others' comments as well. And if you gather comments by sending the files as an e-mail attachment or on a floppy disk, Freelance Graphics automates the process of incorporating all of the remarks from reviewers (whereas with other methods, you simply access the file or you are sent the file, and it has all the comments in it).



Freelance Graphics for Windows 95

Freelance Graphics continues to support data-sharing via Notes and Notes/FX. And now, you can also use NotesFlow, a Notes/FX extension that is geared toward creating workflow applications, to share data;. NotesFlow is basically a Notes/FX extension that is geared toward creating workflow applications.

Another feature, TeamShow, uses Windows 95's Remote Access Services technology to let you to deliver presentations to remote users. The presenter can edit speaker notes while receiving feedback to turn the presentation into a collaborative meeting.

In an important nod to Internet users, Freelance Graphics lets you publish presentations to the Internet. You can read the presentation live on the Web or access a link to the Lotus Home Page and there download the Freelance Graphics Mobile Screen Show Player to play the presentation independently.

Improved SmartMasters feature content-specific information regarding such activities as launching a product, announcing a new benefits plan, and analyzing your competition. The package can recommend a look SmartMaster for each SmartMaster (you may, of course, reject it and use another). Furthermore, there are eight new Multimedia look SmartMasters, and you can add pages that are specific to the SmartMaster that you've chosen.

There is an OS/2 version of Freelance Graphics. The current version, 2.1, has been out since the spring of 1994.

Microsoft PowerPoint

Microsoft PowerPoint for Windows 95, from Microsoft (800-426-9400, 206-882-8200), will incorporate several new ease-of-use features. We looked at a prerelease version of the package., and the final version, which is Windows 95–compliant, is expected to ship in Office 95 within 30 days of Windows 95's release. The pricing of Office was still undetermined at press time. (The standalone version of PowerPoint's estimated street price will be about $339.)

Additions to the new PowerPoint include an AutoCorrect feature to automatically retype commonly misspelled words, a WriteUp feature for sending images of your slides to a Word document, and multiple levels of undo. A customized StyleChecker can scan your presentation and correct capitalization, punctuation, and design flaws in the areas of capitalization, punctuation, and visual clarity (checking for proper use of bullets and fonts, for example).

There are several new templates that have been added, including one for leading a creativity session and one for proposing a business plan. The AutoContent Wizard and AutoLayouts have been improved in this version as well. You can call up the Black-and-White View to help you see what printed copies of your presentation will look like. In this handout view, you can change gray-scale effects and make elements of your presentation either black or white.

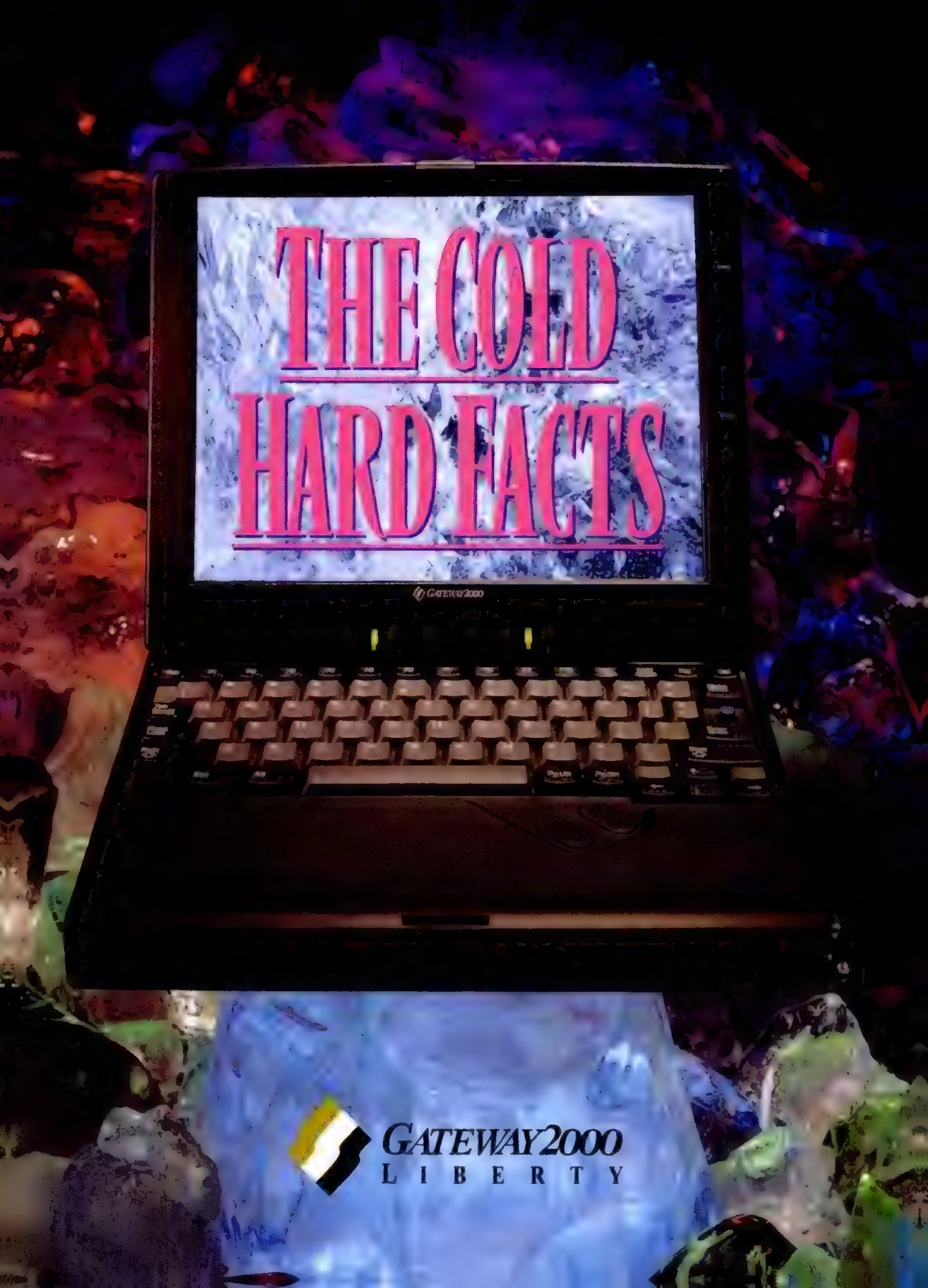
Microsoft PowerPoint

The new Build Toolbar includes buttons for quickly adding text and objects with laser, typewriter, fly-in, and drop-in effects. Many of these effects have sounds attached to them.

You can now add shaded, textured, patterned, and multiple-color fills to elements in your presentation. A CD that's shipped with Microsoft Office includes additional textures as well as high- and low-resolution photos.

Multithreading features are supposed to facilitate background printing and slide-sorter rendering in the new PowerPoint. In addition, the company reports that background printing has been speeded up in the Windows 95 iteration of PowerPoint.

A Presentation Conferencing feature lets you show your presentation to other users on your network (you can still have your speaker's notes appear on your screen) with the new Presentation Confer-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CLEAR-CUT ANSWERS

Your choice of a portable PC may not seem like a crystal clear decision at first. There are about a gazillion portables to choose from. Want some clear-cut answers to what's right for you?

Gateway 2000® offers quality portables with performance and features that'll thrill you to chills. But whether or not a Gateway Liberty™ or ColorBook™² portable PC is the right choice for you, look at these guidelines before choosing your portable PC.

Processor

You'll need a 486DX2 processor at the very minimum. Every Gateway 2000 portable PC includes a DX4 processor. A 486DX4 has the power to make your spreadsheets, graphics and word processing all run better and faster.

Cache

Cache is great — that is when you can find it on a portable — because it gives you a superior performance. Our Liberty DX4-100 includes 256K L2 cache on an accelerated local bus yielding Pentium®-like performance. The ColorBook² includes 512K video cache for great video performance.

Hard Drive

Nothing less than a removable 340MB hard drive will do. In fact, you'll want the largest hard drive you can get. Microsoft® Windows,® DOS® and standard software applications automatically consume around 140MB at the time of purchase. And the Microsoft Windows 95 operating system takes about 160MB. All Liberty and ColorBook² PCs include at least a 340MB removable hard drive that can be upgraded to a whopping 720MB.

RAM (Random Access Memory)

A bare *minimum* of 8MB RAM is best — 4MB wasn't enough last year. To adequately run Windows *and* Windows 95 you'll need 8MB. 8MB will also increase your battery life and improve system performance. All Liberty and ColorBook² systems come standard with at least 8MB RAM and are expandable to 16MB or 24MB RAM.

Screen

When you're talking portables, you want the biggest, clearest display possible without adding weight or hiking up the price.

The 10.4-inch Liberty screen has an incomparable screen size-to-weight ratio of 2.44 giving you 23 percent more active viewing area than a 9.4-inch screen and 53 percent more than an 8.4-inch screen.

The Liberty's 10.4-inch and ColorBook²'s 10.3-inch screens give you the best value available in a color display. With vivid colors and bright, clear screens, you'll forget you're working on a portable PC.

Size and Weight

It's a portable PC — the smaller and the less it weighs, the better! The Liberty and ColorBook² are leaders in these areas.

Batteries

Look for between four and five hours of battery life depending on the processor and RAM. Batteries based on lithium ion will give you the best performance. The Liberty gives you up to five hours or more with power management and a lithium ion battery.

Software

Included top-selling software applications increase the value of your portable PC. Gateway pre-installs Microsoft Works for Windows 3.0 or MS Office Professional 4.3 on all Gateway portables, as well as OAG® FlightDisk® and World Clock software.

Keyboard & Pointing Device

You'll need a keyboard that's comfortable for you and that's also easy to use. The Liberty is equipped with a large palm rest, and flip-out feet so you can adjust the keyboard angle.

Pointing devices vary greatly. Again, find one that's easy for you to work with. Gateway's EZ Point™ integrated pointer is uniquely positioned to be comfortable and easily accessible.

Infrared Technology (IR)

Extras such as the Liberty's IR technology add even more value to your portable PC. With it you can take advantage of wireless file transfer — this means transferring files between the Liberty and your desktop or between two Liberty PCs without cables!

Service

Make sure you have the right support for your portable PC. Gateway 2000 has well-trained, dedicated portables and Windows 95 technical support technicians on call, 24 hours a day, seven days a week, for the life of your Gateway system. We also offer a special VIP warranty.

Sights and Sounds of Tomorrow

Soon you can revamp your lifestyle with our amazing new multimedia portable PC — the Gateway 2000 Solo.™ It touts a powerful Pentium processor and is optimized for Windows 95. So don't be left out in the cold, call for information today!

Now that you have all the facts, go ahead and shop around. Then call one of our friendly sales representatives about the very cool Liberty and ColorBook² portable PCs from Gateway 2000.

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COOL PORTABLES

PC MAGAZINE EDITORS' CHOICE August 1995 Gateway Liberty DX4/100

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- 10.3" DSTN Color Display
- Intel 486DX4 Processor
- 16MB RAM (expandable to 24MB)
- 1.5MB Video RAM (includes 512K cache)
- 540MB Removable Hard Drive
- 3.5" Diskette Drive
- Integrated 16-Bit Sound and Speaker
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- EZ Point Integrated Pointer
- 2 PCMCIA Type II Slots
- 85-Key Keyboard
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encing feature and still have your speaker's notes appear on your screen. A Meeting Minder box lets you add meeting notes and action items while you're giving your presentation. The Meeting Minder creates a slide that includes all the action items, and you can view this slide at the end of the presentation. Finally, the Pack and Go Wizard automates compressing and saving your presentation across several floppy disks, so you can more easily bundle up unwieldy animation files before you go on the road.

Adobe Persuasion

Several companies discussed plans for Windows '95 development but weren't able to deliver pre-release versions of their software. Adobe Persuasion, from Adobe Systems (800-833-6687, 415-961-4400), is currently Windows 95–compatible; a Windows 95–compliant version will be released in 1996.

Action!

Macromedia (800-288-4797, 415-252-2000) plans has stated that it intends to develop a fully 32-bit Windows 95 version of its Action!, but the company hasn't announced any time frame for shipment.

Astound for Windows

Astound for Windows, from Gold Disk (800-982-9888;408-982-0200), will be upgraded to a Windows 95 version and shipped not long after the release of Windows 95. It will be a full The product will be fully 32-bit product, and the company is aiming planning to aim for the Windows 95– compatibility logo. The new version will have OLE 2.0 support and tabbed dialog boxes. Gold Disk will also continue to ship the 16-bit version of Astound.

Harvard Graphics 4.0 for Windows

Software Publishing Corp. (800-234-2500, 408-986-8000) just missed getting us delivering a prerelease version of the new, fully 32-bit version of Harvard Graphics 4.0 for Windows. The product, which is expected to ship within 30 days of Windows 95, will have complete Windows 95 and Windows NT compliance and follow the design guidelines for Microsoft Office. There'll be OLE The product's OLE 2.0 functionality that should surpass the logo requirements; other features will include new import and export filters. The company will continue to ship the 16-bit versions for DOS 3.0 and Windows 3.*x*.

Novell Presentations

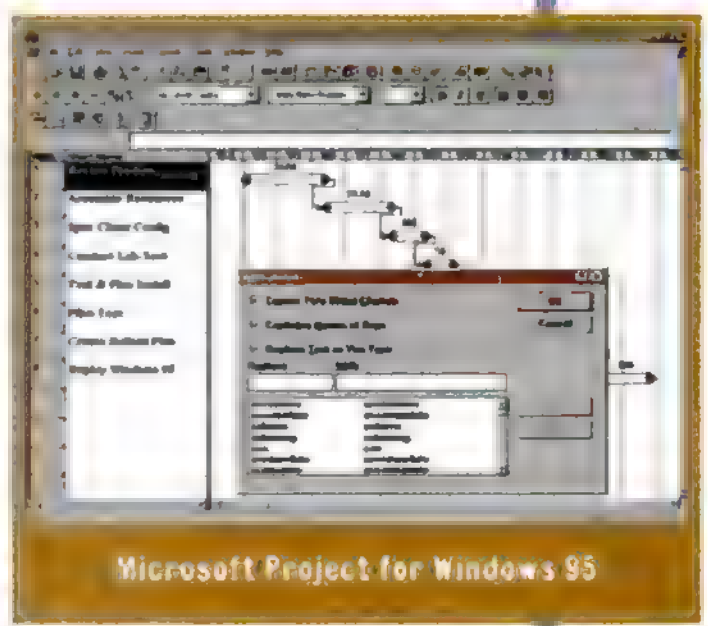
Sometime in the fourth quarter of this year, the Novell Corp. (800-453-1267) plans to ship the Windows 95 version of Novell Presentations. from Novell Corp. (800-453-1267) is due in the fourth quarter of this year. More information will be coming from the company at available at a later date.—*Kathleen Caster*

PROJECT MANAGERS & PLANNERS

Windows 95's built-in workgroup functionality, especially OLE 2.0 and its messaging and database connectivity features, promise much for project management. So far, though, we're seeing only the tip of the iceberg.

Microsoft Project for Windows 95

Although it's not part of the Microsoft Office suite, and is "merely" a point-release—not a full integer—upgrade, Microsoft Project for Windows 95, Version 4.1, from Microsoft Corp., (street price, $469; upgrades, $149; 800-426-9400) will offer many of the same features as its new Office cousins. Like Excel 7 and Word 7, for example, Project 4.1 will allow pre-emptive multitasking and use the new Win 95 common dialogs and property sheets. Microsoft also claims that Project 95's 32-bit code will run faster and make smaller demands on system resources.


Microsoft Project for Windows 95

Like Excel and Word, Project will also offer AutoCorrect, plain-English searches for finding the help you need (the Answer Wizard), and an enhanced File Open with optional full-text indexing. Even stronger document-management services will arrive later this year or sometime next year, courtesy of Microsoft's Exchange Server. A Post to Exchange Folder command will let you store Project files in Exchange Server databases, not as part of the standard file system, and support for custom OLE properties will let users sort and view file lists on the basis of completion status, budget status, or any other prop-

erty of interest.

This version will add more effective integration with Schedule+ and MAPI to Project's already rich workgroup communications features. Custom e-mail forms will make it easier for managers to assign tasks. As before, assigned tasks will show up in workers' Schedule+ files, but now the workers will be able to supply percentage-completion data in Schedule+ and make it automatically accessible to managers.

The new version of Project will allow connectivity with any ODBC-compliant database, eliminating the requirement for Microsoft Access. And some new VBA verbs will simplify programmatic interaction of Project with ODBC data sources.

Milestones, Etc. 4.5 and Milestones Simplicity

Version 4.5 of Kidasa Software's project scheduler, Milestones, Etc. (800-765-0167, 512-328-0167), which shipped in April 1995, comes with separate 16-bit and 32-bit disks in a single box. The latter run in Windows 95 and Windows NT, use the new Win 95 common dialogs, and support long filenames and UNC paths. Kidasa has also redesigned its user interface for greater consistency with Microsoft Office

Important new features in Milestones, Etc., Version 4.5, include server implementation of OLE 2.0, task outlining (to nine levels) with task rollup and summary bars, the ability to filter a task display or sort a display based on column values, a custom symbol designer, and the ability to create custom date headings (thus, organize Gantt charts in nonstandard time chunks such as three-week intervals).

Lest the enhanced analytic capabilities of Milestones, Etc., Version 4.5, overpower users who want to avoid complexity, Kidasa also ships a subset of Milestones called Milestones Simplicity. Priced at $99 (compared with Milestones, Etc.'s $199), the offshoot also comes in parallel 16-bit and 32-bit versions. Simplicity has the same interface as Milestones, but lacks the more sophisticated features like task outlining, custom calendar definition, the symbol designer, custom timescales, and task filtering. Support for OLE 2.0 is included, however.

Project Scheduler 7

Scitor Corp.'s Project Scheduler 7, due to ship in December (800-533-9876, 415-462-4000), will be a Win32 application running only under Windows 95 and Windows NT. It offers a full client-and-server implementation of OLE 2.0, including cross-application drag-and-drop, in-place editing, and OLE automation. For newcomers to project management, a set of Project Guides will provide automated assistance. New analytic features, like the ability to build conditional calculations based on whether or not a project meets particular deadlines, will appeal to users with more sophisticated needs. —*Craig Stinson*

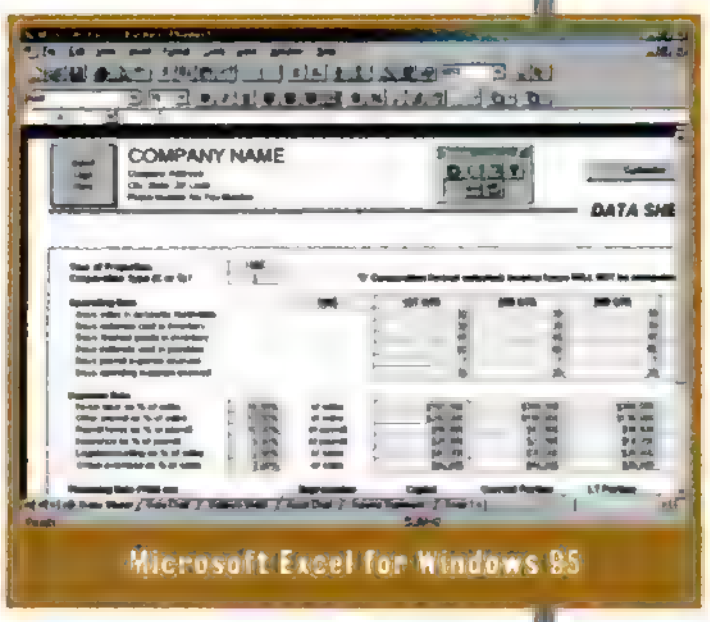
SPREADSHEETS

Microsoft is poised to ship its powerhouse, Excel, hot on the heels of Windows 95 itself. Competitors Lotus and Novell appear likely to lag at least a quarter behind.

Microsoft Excel for Windows 95

Providing robust data-management capability to spreadsheet users is a salient theme in Excel 7. To ease repetitive data entry, Microsoft Corp.'s new Win 95 spreadsheet (the seventh version; list price, $339; 800-426-9400), which will ship concurrently with Windows 95, will look at previous entries in a column and offer to complete the current cell entry before you finish typing it. To simplify ad hoc analysis, the status bar displays the total (or average, maximum, and minimum) of any selected cell range. Another new feature lets multiple users update a worksheet simultaneously and provides for conflict resolution.

For database work, Excel 7 offers tight integration with the forthcoming version of Microsoft Access. For example, you can replace the humble Excel data form with a form designed in Access, complete with validation rules and input masks. And without leaving the worksheet, you can use Access as a report generator for Excel data. A new wizard sets up automatic database tracking of selected cells in a template (the database can be in Access, on another Excel worksheet, or in any other ODBC-compliant format). For applications that have outgrown the worksheet format, Excel 7 can convert your flat file to a set of relational tables, complete with a standard query, form, and report.



Microsoft Excel for Windows 95

Beyond data management, Excel 7—like 1-2-3, Release 5—draws color-coded maps of geographical

If you want to send a message to a customer on a different operating system, you have two options.

Get cc:Mail. Or get a stamp.

With all due respect to the post office, there are more efficient ways of communicating in business. E-mail is a perfect example. Thing is, there's only one e-mail package available that allows you to simply communicate with anyone you want—colleagues, customers, vendors—no matter what operating system (Windows,™ DOS, OS/2,® Macintosh® or UNIX®), host system or e-mail product they use: cc:Mail™ from Lotus.®

In addition, cc:Mail works seamlessly with other Lotus applications like Lotus Notes® and SmartSuite® and is compatible with virtually all other mail-enabled desktop applications, including those from Microsoft® and WordPerfect.® In short, whatever you have, and whatever they have, cc:Mail works. Easily.

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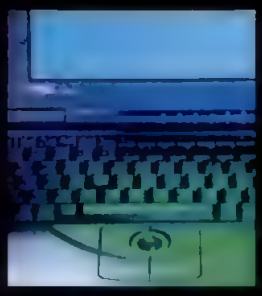

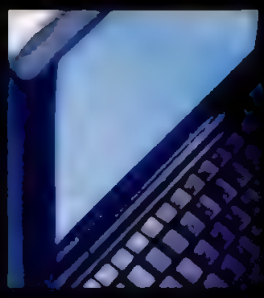

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intel inside pentium processor

data. It also offers simpler numeric formatting, better worksheet navigation, cell notes that pop up from your mouse pointer, and better document management. Microsoft also claims substantial speed enhancements, which we were not able to verify with beta code.

ChartXL 2.0 for Windows

Software Publishing Corp.'s (800-234-2500, 408-986-8000) Harvard ChartXL 2.0 for Windows is a business, technical, and statistical charting package designed to augment the presentation capabilities of Excel and other spreadsheet programs. It will be a certified Microsoft Office 95–compatible application. The program offers a gallery of 195 graph types, covering everything from bubbles to whiskers. It will be a Win32s implementation installable on 16-bit Windows systems, as well as on systems running Windows 95 and Windows NT.

Along with support for long filenames and UNC path constructions, ChartXL will offer new graph types (including two-dimensional and three-dimensional pyramid charts) and the ability to import multisheet workbooks from Excel 5 and 1-2-3, Releases 4 and 5. This version will also be an OLE 2.0 server and container application, providing drag-and-drop data manipulation and in-place editing of embedded objects.

Like the best Windows office applications, ChartXL will offer some automatic formatting options. To assist with data analysis, smoothing, curve fitting, and the like, the new ChartXL will also offer an analysis toolbar.

Lotus 1-2-3

The newest version of Lotus 1-2-3 from Lotus Development Corp. (800-343-5415)—a fully rearchitected product with a new file format—is scheduled to enter beta testing this fall. Initial release will be on the Windows NT and Windows 95 platforms (price to be announced), with an OS/2 version to follow.

The new Lotus 1-2-3 will also be more tightly tethered to both its SmartSuite mates and to Lotus Notes. In particular, a Version Manager upgrade called Team Consolidate will allow users to save Lotus 1-2-3 worksheets as Notes documents, split them up for distribution to multiple reviewers, and send them out. Notes will keep track of comments and revisions and automatically reassemble the pieces. The product will also incorporate LotusScript, the company's cross-application scripting language.

Quattro Pro 7 for Windows 95

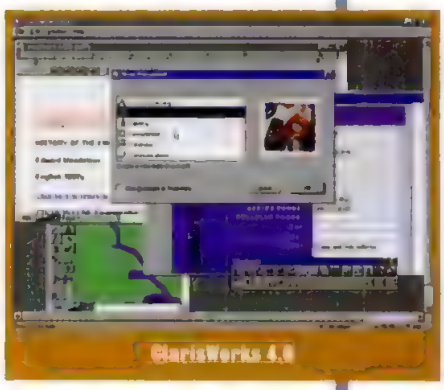
Novell's Quattro Pro 7, though in a prebeta stage of development at press time, will be a full-fledged Win 95 citizen and ship by the end of the year (price to be announced), meeting all the basic requirements. Quattro Pro 7 will use a natural-language help system and offer support for Lotus Notes F/X. It will include a complete implementation of Novell's cross-application scripting language, PerfectScript.—*Craig Stinson*

SUITES & INTEGRATED PACKAGES

Microsoft will be first out of the gate with a Win 95 version of its full-scale suite, with Lotus and Novell following months behind. Claris and Microsoft will have versions of their respective Works packages ready around the time that Win 95 hits.

ClarisWorks 4.0

Claris Corp.'s all-in-one suite, ClarisWorks 4.0 (list price, $99) , includes a word processor, database, spreadsheet, drawing module, and painting modules, plus up-to-the-minute features like HTML import and export. A set of Assistants—Claris's answer to Microsoft's Wizards—walk users through the tasks of creating presentations, address books, certificates, calendars, mailing labels, and spreadsheets for home finances. The graphics tools used in the painting and drawing modules are also available in the word-processing and spreadsheet modules, and they include advanced features like object rotation, gradient fills, and spline curves. Unlike Microsoft Works or Novell's PerfectWorks 2.1, ClarisWorks doesn't support drag-and-drop of text and graphics between windows.



Other features available throughout the suite include named and editable styles, color settings, and a toolbar that displays icons or names (or both) and can include custom macros. The modules themselves include smart quotation marks, snaking columns, custom facing-page

Microsoft Office for Windows 95

layouts, an outline mode, and multiple windows opening on different places in the same file. The database supports graphic features like radio buttons and check boxes, which appear even when you view the database in a spreadsheet-style display, not as a fill-in form. The spreadsheet fills in months and years, includes impressive graphics support, and a solid choice of functions, but little advanced automation. A communication option merely offers a link to the Windows 95 HyperTerminal applet.

ClarisWorks 4.0 lacks the dazzling automation of Microsoft Works, but its sensible design, easy-to-use graphics, and generous supply of well-designed templates make it a strong contender in the market for integrated suites.

Microsoft Office for Windows 95

Microsoft Officefor Windows 95, which comprises Access, Excel, PowerPoint, Schedule+, and Word increases the level of integration among the already intimately related elements of the suite from Microsoft Corp. that will ship concurrently with Win 95 (street price, $599; 800-426-9400). The new features add enough value to compensate for some loss of backward compatibility with the Windows 3.*x* versions. (Although Word and Excel use the same file formats and essential functionality as before, Access and PowerPoint are completely revamped.)

The most impressive integration tool is a new "binder" application. You drag multiple documents from separate applications into a binder where each becomes a fully integrated section of a single file. As you scroll through the sections of the binder file, the application that created them takes over the top-line menu and toolbars, so you can edit the sections in the same environment in which you created them.

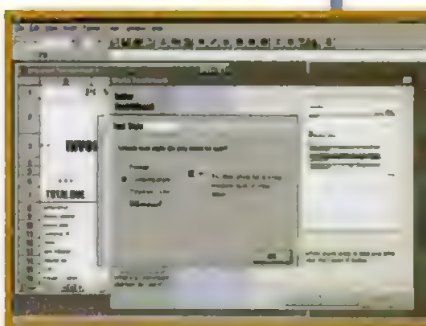
In place of the low-powered Microsoft Office Manager of earlier versions, Office 95's control center is an elegant Microsoft Office Shortcut Bar, from which you can open or create files for any Office application. The toolbar can hold icons for any application or document, but it doesn't support cross-application macros of the kind that integrate Novell's PerfectOffice. Although Microsoft promises to make Visual Basic for Applications (VBA) the shared development environment of the entire suite (Word and PowerPoint lack it), it hasn't yet achieved this crucial integration feature.

Meanwhile, Microsoft Office's other integration features represent the cutting edge of OLE technology. PowerPoint graphs can be dragged directly into Excel or Word. Excel spreadsheets can be converted, through one of Office's wizards, to an Access relational database. And data entered into Access forms can be funneled into an Excel spreadsheet. The Microsoft Bookshelf 95 collection is bundled with the CD-ROM version of the suite.

Microsoft Works for Windows 95

Microsoft Works for Win 95 contains a word processor, database, spreadsheet, and self-contained communications module, all with drag-and-drop between modules. The whole package (street price, $54.95; from Microsoft Corp., 800-426-9400) will ship concurrently with Win 95. It is saturated with help screens, and special-purpose cursors, like the ones that appear when you adjust the width of a spreadsheet column, have helpful descriptive labels. Whenever you create a document, the program offers to guide you through the process with one of 39 of Task Wizards, which look like decorator-styled versions of Microsoft's familiar Wizards and ask fewer questions. Everything in the package is a triumph of clarity, elegance, and automation. And even if you prefer to use the modules without the wizards and templates, you'll find most of the advanced features of Microsoft's standalone apps.

The word processor uses the most accessible paragraph styles anywhere, complete with preview and descriptive titles. It supports smart quotes, columns, boilerplate text, and a flexible mail-merge feature. The spreadsheet module does the work of creating most cell formulas for you and includes a charting feature. The database guides you through the creation of fields, including one for serial numbers. The communications module records log-in scripts and has a built-in link to the Works forum on the Microsoft Network.


Microsoft Works for Windows 95

Works uses Microsoft's standard Draw Module as its graphics editor, which means that Works can't compete with ClarisWorks if you need advanced drawing tools. But everything else in this impressive integrated suite is powerful enough to make small businesses and home users think twice before buying standalone apps. As a bonus, the CD-ROM version (street price, $79.95) comes with a copy of Microsoft Bookshelf 95.

Lotus SmartSuite for Windows 95

Lotus Development Corp.'s new version of SmartSuite, which is due in the fall, will build on the strong new features in Word Pro, extending them to other applications in the suite. The suite includes Approach, Freelance, Lotus 1-2-3, Organizer, ScreenCam, and Word Pro. A feature that is tentatively called Drawers will resemble the Binders in Microsoft Office, which combine multiple documents in one file. Lotus, however, will build in tasks and scheduling so that a Drawer acts as an automated system that can update and distribute documents.

Word Pro's ability to consolidate in a single document the editorial changes that are made by all the members of a workgroup will be built into a new version of Lotus 1-2-3. Each member of a workgroup can contribute or revise his or her portion of a spreadsheet at any time. Word Pro's InfoBox feature, which puts a context-sensitive tabbed formatting dialog box on screen at all times, will be built into other applications. The LotusScript 3.0 macro language will be built into all of the applications eventually, and integration with Lotus Notes will increase throughout WordPro. —*Edward Mendelson*

UTILITIES

Microsoft has built strong file- and system-management utilities into Windows 95, but, as always, third-party developers are devising stronger ones. We've limited coverage here to utilities that make special use of Windows 95 features and are not simply 32-bit ports of existing programs. Many Windows 3.*x* and traditional DOS utilities will continue to work under Windows 95, but you shouldn't even try to run any pre-Windows 95 utility that writes directly to the disk, tests for viruses, or manipulates Windows memory.

The Norton AntiVirus

Symantec Corp.'s update of The Norton AntiVirus (street price, $79; 800-441-7234) is the first and so far the only program of its kind that runs under the Windows 95 environment. It includes all the conventional anti-virus features: a scanner that surveys memory and files either on command or on a preset schedule; an inoculation function that tests crucial files for changes during bootup; and a background module that checks programs as they load and blocks suspicious attempts to write to disk. Anyone who relies on anti-virus software under Windows 3.*x* should install this package immediately after installing Windows 95.

Also, be aware that if any of the most common boot-sector viruses is present or if the driver can't be loaded, Win 95 detects that something is wrong with the file system and blocks most boot-sector viruses from infecting disks. And it displays a message in the Control Panel's System applet, on the Performance tab. You do have to take the trouble to look there to discover the problem, of course.

The Norton Navigator

To create The Norton Navigator, Symantec Corp. (800-441-7234) combined technology from The Norton Desktop for Windows and PC Tools for Windows, and added some special features for Windows 95. The resulting package (street price, $99), like its predecessors, includes some spectacularly useful enhancements to the operating environment, together with a few features that add complexity rather than convenience.

The best features of the program are the ones it adds to the operating system and other applications. It transparently lets Windows 3.*x* applications read Windows 95's long filenames in the applications' File Open dialogs. It supports multiple desktops and displays thumbnails of each on the Taskbar. It also lets you drag application or document icons to the Taskbar for quick access, as in the OS/2 LaunchPad. One feature adds lists of recently opened files and folders to the File Open dialogs in other applications, and another adds file-management functions to the right-click menu in the Windows Explorer. One annoying feature clutters up the Start menu with more items than you probably want, but you can always choose which feature to use and which to turn off.

Among standalone programs in the package, the main attraction is the Norton File Manager, built on the superb XTree for Windows 3.*x*; it now has built-in addresses for major FTP sites on the Internet. Other standalone utilities include an undo program that re-

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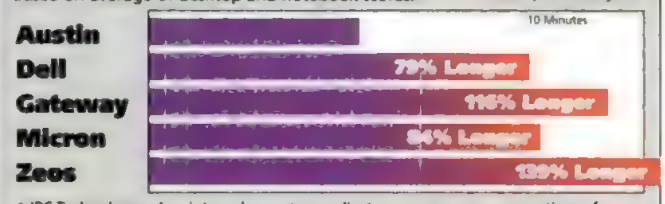
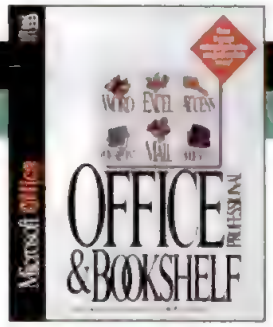
Tech Support Average Response Time

Based on average of desktop and notebook scores. Source: July 1995 PC Magazine



* IPC Technologies, Inc. internal reporting indicates an average response time of under 2-minutes. Industry average is 8.7 minutes. Actual times may vary.



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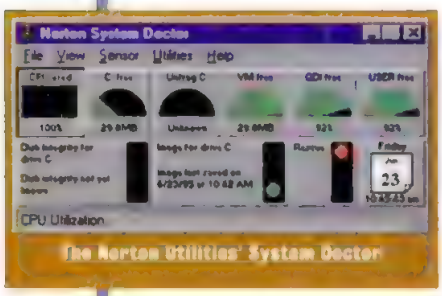
verses file operations like creating, deleting, or renaming files and folders; an Archive Wizard that compresses files that you haven't accessed recently; and a file finder called FastFind. The only major disappointment of The Norton Navigator is Symantec's decision not to update Central Point Backup for Windows, formerly included in PC Tools for Windows. This decision leaves hundreds of thousands of users without an update to one of the most flexible and reliable backup programs on the market.

The Norton Utilities for Windows 95

Symantec Corp.'s The Norton Utilities for Windows 95 (street price, $119; 800-441-7234) is intimately linked to Win 95 but keeps a foot in DOS. When you install, you get the option to enhance the Windows Recycling Bin with features that keep track of all files deleted by applications—files that otherwise are simply deleted without going to the Recycling Bin. An UnErase Wizard walks you through restores from the Recycling Bin or recovery of other deleted files. If you want to clear out files instead of recovering them, a Space Wizard finds temporary, backup, long-unused, and duplicate files and offers to delete them.

The classic Norton Disk Doctor is included in the DOS-based and Windows version (complete with a high-resolution photo of Peter Norton), and the DOS-based disk editor has been updated to recognize long filenames. The Speed Disk defragmenter can run in the background, but caution warns against using it that way without a full set of backups. The Norton System Doctor monitors your system in more detail than its counterpart in the previous version. And a new System Information application reveals the internals of your system in even more detail than the Control Panel. You probably won't use the Norton Utilities every day, but when you need them, you'll be very glad they're there.



The Norton Utilities' System Doctor

ObjectBlox

This innovative new $69.95 ObjectBlox from Alpha Blox (800-451-1018) lets you create Post-It-style notes, calculations, tabular lists, or almost any other alphanumeric odd or end, and embed them in documents or store them on the desktop. This clever utility, available by the time you read this, consists of three parts: a note editor, with word-wrap, selectable fonts, and simple templates for phone messages, meeting announcements, to-do notes, and similar items; a calculator with multiple keypad styles and a record of entries in paper-tape style; and a list recorder that looks like a spreadsheet without math functions, in which you enter a to-do list, complete with colored cells that you use to indicate the status of a task.

Each of these modules is both OLE server and client, so you can embed notes in OLE-aware applications or leave them on the desktop in the form of Windows 95 scrap objects, complete with links to word processor or spreadsheet files in which another copy of the note is stored. Before you buy, keep in mind that if all you want to do is save scraps of text to the desktop for later use, you can accomplish this simply by dragging a selection from WordPad to the desktop.

Remove-IT 2

Most of the features in Vertisoft System's $39.95 (street price; 800-466-5875) Remove-IT, Version 2, are designed to aid in removing applications and extraneous files from Windows 3.1. But it also includes a module that helps in transferring files and program groups from 3.1 to Windows 95. This module first catalogues your 3.1 Windows directory and groups, then offers to move them either individually or en masse to Win 95. This procedure works best if you transfer all your old programs. If you want to move only a few, you have to figure out yourself which of the files in your old Windows and Systems directories have to be moved along with them. In the absence of more precise utilities to help you upgrade, Remove-It can help streamline the process, provided you use it with enough care to avoid overloading your Windows 95 directories with extraneous files.

TabWorks 2.0

TabWorks 2.0 (from XSoft, a division of Xerox Corp.; list price, $49; 415-424-0111) uses a notebook metaphor to shield users from the complexity of the Windows environment. You organize applications and files on tabbed pages, complete with an index. In TabWorks' Win 95 version (which is packaged

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TabWorks 2.0

with an updated Windows 3.x version), TabWorks supports multiple notebooks that are displayed on a bookshelf, complete with drag-and-drop between notebooks or between notebooks and the desktop. An optional feature that detects newly created files has a message that pops up to ask if you want to add the file to a notebook page. Advanced users may find that TabWorks adds a needless additional layer to the rich file-management features that are built into Windows 95, but less sophisticated users may find TabWorks helpful as an organization tool.

WinZIP 6.0

Nico Mak's $29 WinZIP 6.0 deftly integrates the best of the Windows ZIP utilities into the Windows 95 environment. All of WinZIP's familiar features are retained in the new version, including the invaluable check-out option that lets you temporarily install, run, and then remove the contents of a ZIP file. But Version 6.0 adds a menu option to the Windows Explorer's right-click menu that lets you add the selected file to a ZIP file with a couple of mouse clicks.

Furthermore, you can extract all the files in a ZIP file by dragging its icon in the Explorer to any directory and right-clicking on the mouse. Or you can create a ZIP file by dragging files from the Explorer to WinZIP's icon. WinZIP continues to reign as the one essential ZIP manager. And as a bonus, it also manages ARC, ARJ, LZJ, and TAR files. Shareware copies can be found on all on-line services, or order a copy from the Public Software Library (800-242-4775, 713-524-6394).

Arcada Backup for Windows 95

Only one desktop-based back-up package seems to be on tap for Windows 95: the $99 (list price) Arcada Backup for Windows 95, from Arcada Software (407/333-7500). The barebones backup software that comes with Windows 95 works only with QIC tape drives and disks. But Arcada will support those formats and also SCSI tape, with Wizards for helping to automate backup procedures.

Adobe Type Manager

Some major upgrades to classic utilities were still waiting in the wings when we went to press. Adobe was in the early stages of designing a new version of ATM that will include font-management features.

Dashboard 95

Starfish Software (800-765-7839) is working on Dashboard 95 (street price, $49.95), an upgradeto theclassic shell program that will ship concurrently with Win 95. Dashboard 95 replaces the Win 95 Taskbar with compact, effective program and printer-management features.

QEMM 8

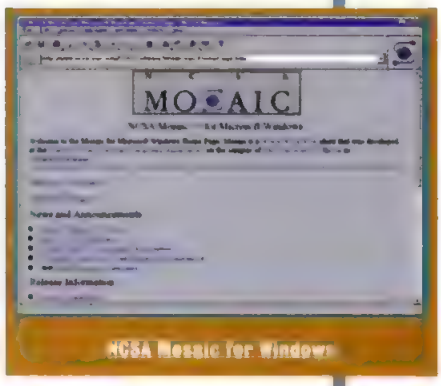
This version of Quarterdeck Office System's memory manager, QEMM 8, increases available RAM for DOS apps and drivers under Win 95, and, for Windows 3.x, increases resources.—*Edward Mendelson*

WEB BROWSERS

In the fast-moving world of the Internet—where the prevailing ethos is to use the latest and greatest—browser vendors are rapidly moving their wares to 32-bit versions to coincide with the release of Win 95.

Internet Explorer

Microsoft will enter the Web browser world with its Microsoft Plus! Internet Jumpstart Kit. Using Microsoft Network as the Internet access point, the Internet Jumpstart Kit includes Internet Explorer, a Win 95 World-Wide Web browser based on Enhanced Mosaic, and an Internet mail reader that accesses Microsoft Exchange. And a set-up wizard can be used to configure Internet Explorer for use with other Internet service providers.



NCSA Mosaic for Windows

Like Netscape Navigator, Version 1.2, Internet Explorer uses shortcuts that can be placed anywhere in the Windows 95 environment (folders, files, or mail mes-

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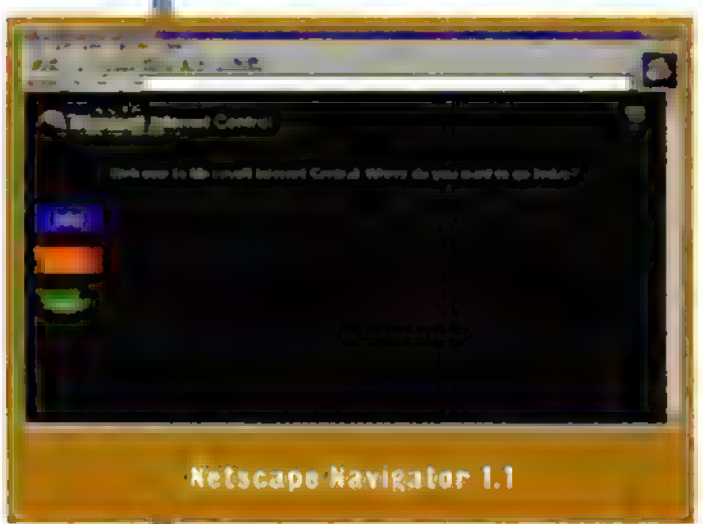
sages). These shortcuts can be clicked, which will bring up the original application configured for the task at hand. Microsoft Plus! will be available at a retail price of $49.95, but the various components will be available free of charge when downloaded from The Microsoft Network or the Microsoft FTP server.

NCSA Mosaic for Windows

The mother of all Mosaics, NCSA Mosaic for Windows, is also available in a 32-bit version: As we write this, a beta version (2.0.0, beta 4) is available for download at *ftp.ncsa.uiuc.edu/Mosaic/Windows* the self-extracting filename is *mos20b4.exe.* NCSA Mosaic is a very basic browser that's not quite at the level of the commercial packages (for instance, you can send mail but not receive it). For more information about NCSA and the software, you can point your existing Web browser to *>http://www.ncsa.uiuc.edu:80/SDG/Software/WinMosaic/HomePage.html.*

Netscape Navigator

When Netscape Communications released a 32- bit version of Netscape Navigator 1.1 in midsummer, the company essentially kicked off the Windows 95 war. That version was quickly followed by the release of Netscape Navigator 1.2, which explicitly supports Windows 95. Features include drag-and-drop Uniform Resource Locators (URLs); Windows 95 dialog boxes for functions like saving and printing files; and Internet Shortcuts, which can be used to create clickable icons that represent a specific URL. (For instance, a Shortcut with Navigator and the URL for Yahoo can be placed on your desktop to be used anytime you want to check Yahoo.) These Shortcuts can be used anywhere within Windows 95 (on the desktop, inside folders and directories, or as embedded mail objects).


Netscape Navigator 1.1

Finally, the Navigator interface has been upgraded with Enhanced Bookmarks, which are organized within folders and can be dragged and dropped between folders.

At press time, the 32-bit version of Navigator (with the filename *n3212b1.exe*) was available at *ftp.netscape.com,* in the *pub/netscape1.2b1* directory. (This is a busy site, so you may want to check out its mirror sites, which are listed at *http://www.mcom.com/comprod/mirror/index.html.*) Netscape's asking price for a licensed copy is $39, but it is not yet included with the retail Netscape Navigator Personal Edition.

Enhanced Mosaic

Spyglass, official licenser of Mosaic and consequently Netscape Navigator's main competitor in the World-Wide Web marketplace, has no current plans to bring out a Windows 95 version of the popular browser under its own name. But the company will continue to license its code to various other vendors for customization, so it will be the basis of numerous commercial implementations.

Spry Mosaic

A 32-bit Spry Mosaic will be featured in Windows 95 Mosaic in a Box for Windows 95 (from CompuServe Internet Division; 800-777-9638), which should be shipping by the time you read this. With an anticipated street price of around $10, Spry's goal is to create a one-stop Internet browser from which you can cruise the Web, as well as send and receive electronic mail and browse Usenet newsgroups. Users will have the ability to send and receive mail either through standard SMNP and POP3 connections.

Internet connections will be handled via the CompuServe Network or through a local service provider. The package will also include a 16-bit version of Spry Mosaic for those not moving to Windows 95.

Eventually, CompuServe plans to move 32-bit Spry Mosaic to all its Internet packages, including Internet in a Box (scheduled for a November release) and Internet Office.—*Kevin Reichard*

WORD PROCESSORS

Microsoft may hold the bulk of the market now, but it's in for some stiff competition in the word-processing arena as Lotus gets its totally revamped and renamed Word Pro to market relatively early in the Win 95 era. WordPerfect will join in around the turn of the year, but wasn't close to beta release at press time.

Lotus Word Pro

Prepare to be dazzled by Lotus's Word Pro for Win 95 (street price, $105; from Lotus Development Corp.; 800-343-5415); the successor of the Win 3.*x*-based AmiPro was worth the long wait. This spec-

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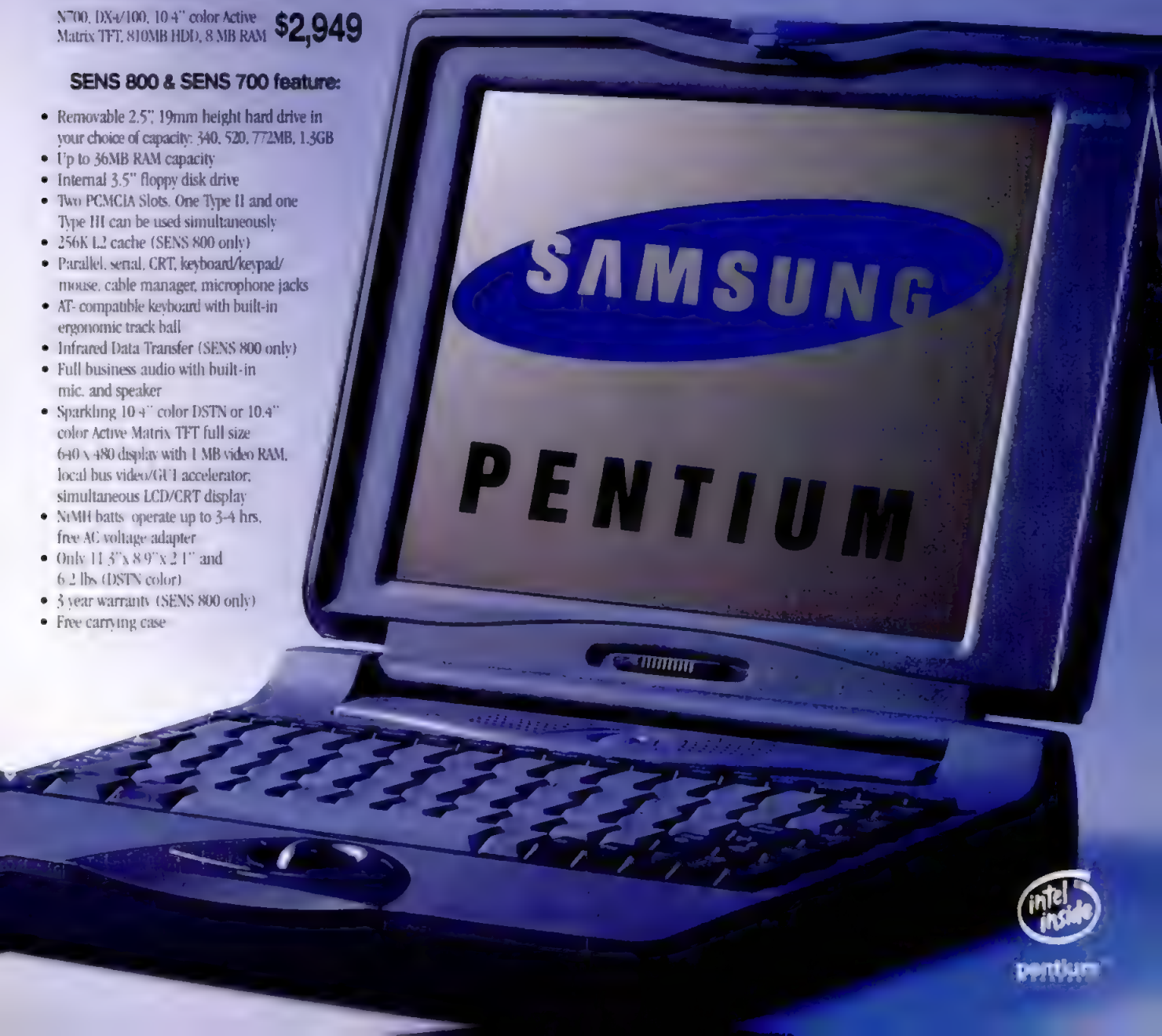
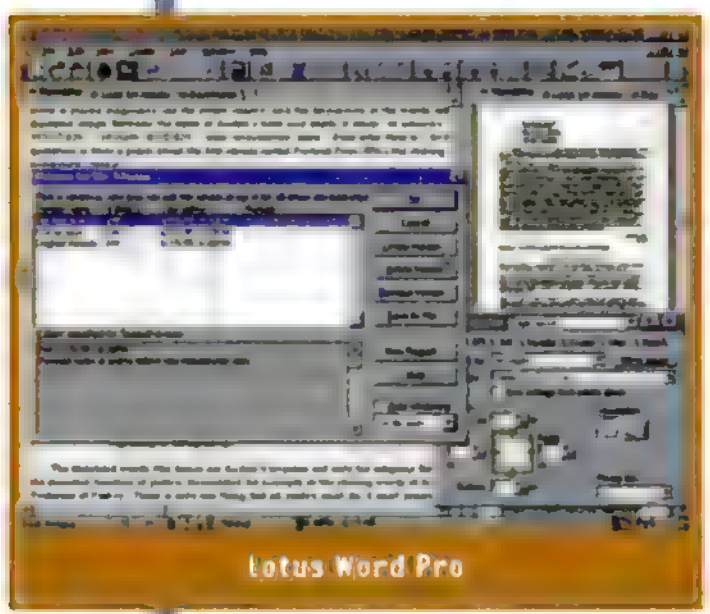


tacular word processor represents the most intensive and innovative thinking in any application since the early days of Windows. Everything about it, from its divider tabs for quick access to different sections of a file to its elaborate access security controls, has been brilliantly pondered for maximum convenience and power.


Lotus Word Pro

Word Pro's unique ability to preserve and display multiple versions of the same document in a single file—an essential feature for audit trails in the legal, publishing, and government markets—virtually wipes the competition off the map. It surpasses everything else on the market with its support of simultaneous group editing; it has features that include highlighting, annotations, hidden deletions, and a toolbar that can report who wrote any sentence.

Where Ami Pro never allowed you to see more than one page at a time, Word Pro can display editable thumbnails on the same screen with multiple windows on the same file. The undo feature is effectively unlimited. Word Pro improves on Ami Pro's already strong graphic, charting, and image-management features, and now lets you nest any object inside any other—such as a table within the cell of another table. The program can retrieve files from the Internet, edit them, and copy them back to the server if you have access rights to it. Word Pro supports LotusScript 3.0, a shared macro language that will eventually work across all Lotus applications.

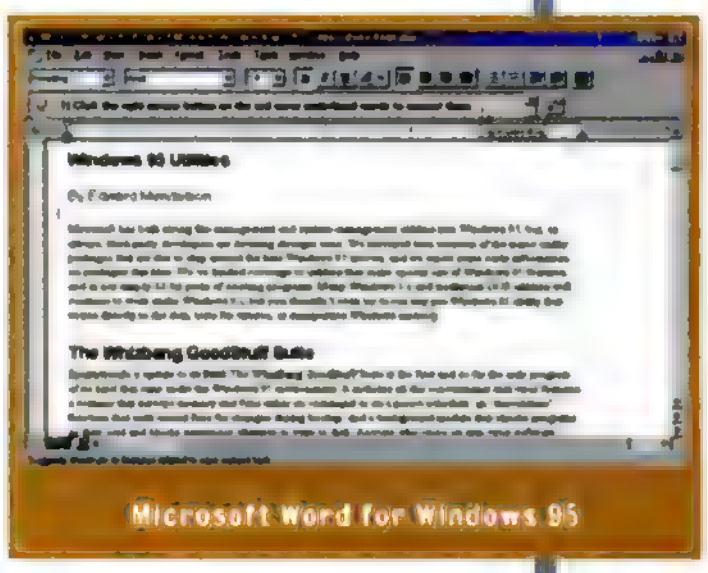
Hundreds of other major and minor advances make Word Pro the program that could make long-entrenched users of WordPerfect and Word for Windows switch.

Microsoft Word for Windows 95

Word for Windows 95 is an evolutionary upgrade that offers welcome convenience features and thorough integration into the Windows 95 environment. But it probably won't excite long-term users who were hoping for major changes like the still-forthcoming switch from WordBasic to Visual Basic for Applications as Word's development environment. Everything is far more snappy and responsive than in Word 6.0, and users of Microsoft Mail will be pleased to find that Microsoft Exchange Mail can use Word in place of its own limited built-in editor. Microsoft Corp. (800-426-9400) plans to ship Word concurrently with Win 95 (list price, $339).

Virtually all of Word's menu structure is unchanged, including the least logical parts, and the program's enhancements are slipped in unobtrusively in existing features. Word now includes the address-book feature pioneered by WordPerfect, but improves on it by using a single address book for all features in the program, from envelopes to fill-in templates. Automatic formatting now makes bulleted and numbered lists literally effortless: You simply start a paragraph with a number and a period, and the next paragraph automatically begins with the next number; or, if you start a paragraph with a hyphen, the hyphen changes into a bullet when you press Enter, and the next paragraph starts with another bullet. Automated spell-checking can mark misspelled words with wavy underlines as you type. These features can be turned off when they become more annoying than helpful.

Word's integration with Windows 95 isn't limited to long filenames and other standard interface conventions. You can select text in a Word document, drag it to the desktop, and drop it to create a Win 95 scrap object that can then be dragged into other programs. Word finally uses the Windows-standard File Open dialog, and finally remembers the directory you used the last time you inserted a graphic so you don't have to navigate to it again and again. Word 7.0 won't thrill anyone, but it gives quiet satisfaction in plenty.


Microsoft Word for Windows 95

WordPerfect for Windows 95

Among the notable convenience features planned for the successor to WordPerfect for Windows 95, Version 6.1 (scheduled to ship in late 1995 or early 1996), are history lists in virtually every dialog box. These will let you scroll down through recently retrieved files, select from recently used fonts, and search again for recently used search strings. Like Microsoft Office with its binder files, WordPerfect will support wrapper files that encompass multiple documents. An information point feature will display details on whatever is under the mouse pointer—for example, the exact coordinates of graphics.

—Edward Mendelson

What's new for OS/2?

You want the benefits of 32-bit applications, but you're not so sure about an untested operating system: Why not check out the latest the OS/2 world has to offer?

By Kevin Reichard

Don't look now, but 32-bit desktop software isn't new. Users of IBM OS/2 Warp and its predecessors have had true 32-bit graphical applications at their disposal for years. In fact, IBM claims there are over 2,000 OS/2 applications out there.

True, if you scratch the surface, you quickly discover that most of these are vertical-market applications, not general business programs. On the other hand, even though the range of apps written expressly for OS/2 isn't nearly as wide as for Windows 3.*x* or even MS-DOS, OS/2 users can have their cake and eat it too to a large extent: With OS/2 Warp you can run 16-bit DOS and Windows programs in addition to native OS/2 apps. (The same does not hold true for 32-bit Windows 95 or Windows NT applications, however.)

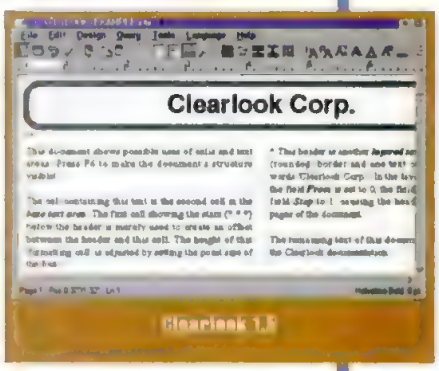
In the following pages, we'll look at recent OS/2 products in all the major software categories. Shortly before press time, unattributed press reports indicated that the European StarOffice product would form the core of IBM's own upcoming desktop applications offerings. IBM officials would not comment. In any case, don't forget that OS/2 Warp features a decent set of applications in its BonusPak, which contains IBM Works, an Internet connectivity suite, fax, and data communications software.

WORD PROCESSORS

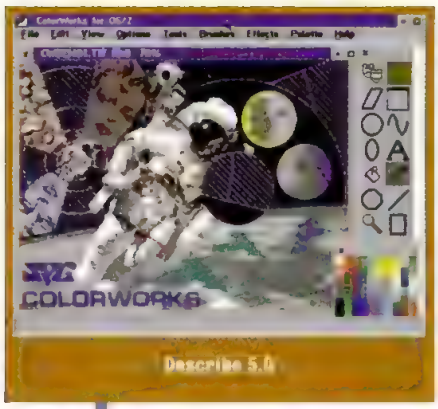
The most full-featured word processor in the OS/2 world is DeScribe Word Processor, Version 5 (street price, $49.95; from DeScribe, 813-732-5500). DeScribe is a complex package, frequently crossing the line between word processing and page layout/ desktop publishing. But DeScribe's efficient organization allows you to work on whatever level you need: Sitting down and creating a basic document with DeScribe is easy—and preparing highly elaborate documents is equally simple, thanks to an efficient menuing layout.

All the advanced document-management features you'd expect (footnotes, tables of contents, tables, sorting, mail merge, master-document management) are present. DeScribe, Version 5, may also be the best bargain in the computer world: For the modest price, you get a manual and a CD-ROM (dubbed Voyager) containing the OS/2, Windows NT, Windows 95, and Windows 3.1 versions.

A relative newcomer to the OS/2 world is Clearlook 1.5 ($169 from Clearlook Corp, 800-818-5665). This package is a basic word processor, containing all the features you'd expect—spell checking, search and replace, and mail merge. And Clearlook is a snappy, responsive word processor that is great for moving quickly in larger documents. It can be a tad quirky at times, however.



Object orientation is heavily emphasized in this package, more in the way a desktop-publishing program treats a document and its pieces (a footnote is an object, a graphic is a tethered object, and so on). Clearlook could benefit from a longer list of supported file formats, which is now limited to WordPerfect data import and text export. Still, this is a product on the rise, and a slight upgrade that will include import from and export to Microsoft's Word and Lotus's AmiPro will be available by the time



you read this.

Finally, Lotus Development gives us AmiPro for OS/2 2.0. AmiPro is a straight port of the Windows 3.*x* version and offers the smoothest transition for anyone moving from Windows to OS/2. But according to Yuko Takagi, product manager for SmartSuite for OS/2, the product as we know it is not long for this world. Lotus plans to replace Ami Pro of SmartSuite with Word Pro on the Win 95 and OS/2 platforms by the end of the year. See our preview of Lotus's Word Pro and for details.

GRAPHICS

On the surface, the image processing and editing package ColorWorks for OS/2 1.0 (list price, $495; from SPG, 305-362-6602) looks like other sophisticated graphics tools, such as PhotoShop. But once you start using ColorWorks you'll see many advanced features not in other packages. For instance, you can use SMP Smart Threading to distribute the processing load on up to 64 CPUs. Further, you can zoom or pan an image at any point in the editing process, including drawing. You can even edit compressed images, which saves on the amount of RAM needed to edit large images in ColorWorks.

The well-established presentation graphics package, Lotus Freelance for OS/2 2.1 (street price, $379; from Lotus Development, 617-577-8500) ships both separately and as part of SmartSuite for OS/2. As with Ami Pro, you're not getting the most recent version of Freelance, but Lotus's future plans include releases of its updated suite across platforms in the fall.

DATABASE TOOLS

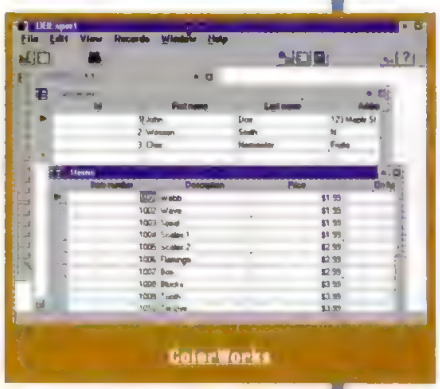
In the past, looking for a serious database application was a futile task in OS/2; they just didn't exist. But two recent software releases have remedied this.

DBExpert (list price, $299; from Designer Software, 800-519-9574) is built along the lines of Microsoft Access or Lotus Approach: a graphical database manager accessible enough for entry-level database users, but with enough advanced features to interest the professional user. Just enough.

DBExpert excels at creating database forms via a WYSIWYG designer. These can be multilayered: A form may lead to a subform, and that subform can lead to yet another subform. Each form can be varied in terms of colors, fonts, and layouts; or layouts can be copied between forms.

Database developers will enjoy the ease of creating forms, but they will be frustrated by the lack of an internal programming language and the inability to create compiled, executable files. Another significant drawback for many users is DBExpert's failure to import or export databases in any but ASCII format.

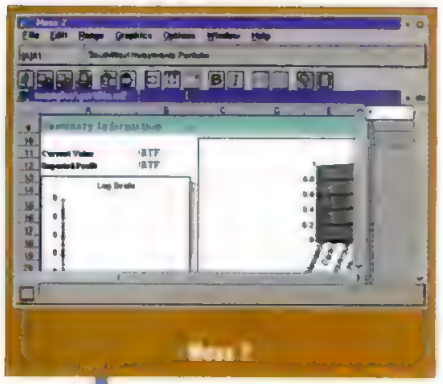
Corporate professionals may instead look to IBM Corp.'s release of DB2 for OS/2, Version 2.1 (list price: single-user version, $495; network version, $1,995; 800-426-2255), a major upgrade to the database-development environment that spans the IBM product line. DB2 for OS/2 is less an end-user database than an extraction tool for sending and receiving data from the big iron on the network. Indeed, the product's main audience is the networked MIS/DP world, where database applications can be developed on one platform in a variety of languages (REXX, C, COBOL, OR SQL, for example) and then migrated to other DB2 implementations across the enterprise.



SPREADSHEETS

The tried and true OS/2 spreadsheet would be Lotus 1-2-3 for OS/2 2.1 (list price, $199; from Lotus Development Corp., 800-315-6372, 617-426-6372). Although, as with other Lotus apps for OS/2, it has not been revised as recently as versions for other platforms. On the plus side, 1-2-3 for OS/2 features numerous OS/2-specific features, such as integration with Presentation Manager. And keep in mind that the impending fully rearchitected release of 1-2-3 under development for Win 95 will be available in an OS/2 version before the end of the year.

For the more adventurous OS/2 spreadsheet users, Mesa 2 for OS/2 (list price, $199; from Athena Design, 800-315-6372, 617-426-6372) is an application written from the ground up for OS/2 and Presentation Man-



ager. Mesa 2 is a fully multithreaded application, which means that each worksheet is essentially a separate program: Recompiling a large spreadsheet in one OS/2 window shouldn't drag down performance in other Mesa 2 windows. The same technology allows data to be imported to Mesa 2 in the background in real time while you continue working on other spreadsheets. Finally, Mesa 2 offers full REXX support for scripting, as well as the ability to import Lotus 1-2-3 and Microsoft Excel spreadsheets.

TELECOMMUNICATIONS

The communication and fax modules included in the OS/2 Warp Bonus Pack may fill your basic telecommunications needs. But if you need to move to a higher level, check out our last roundup of telecommunications tools, "Do You Still Need Comm Software?", in which we reviewed TalkThru for OS/2 and Pmcomm.

Also noteworthy is RhinoCom (list price, $199; from Rhintek, 800-234-4546), one of the only comm packages totally integrated into the Presentation Manager world, which makes the file management associated with telecommunications fairly painless: And aversion expected later this year will let you just drag-and-drop files to send or receive them.

CompuServe users will want to check out Golden CommPass 2.20 (list price, $99; from Creative Systems Programming Corp., 609-234-1500), which allows you to retrieve messages selectively from CompuServe forums and read them off-line.

UTILITIES

OS/2 Warp's interface is something only a mother could love, and its file-management tools are wanting. But these problems make great opportunities for third-party software developers, as evidenced by the wide variety of OS/2 utility packages that directly address interface issues.

A typical effort is SkyScraper 1.1 (list price, $49; from Binar Graphics, 800-228-0666), which consolidates almost every important OS/2 system function under a single toolbar. For instance, you can drag-and-drop your favorite applications into the SkyScraper toolbar, making them all accessible with a single mouse click. Similarly, you can set up as many as eight "offices" (essentially, different toolbar configurations) and move between them: One might be devoted to creating large documents, another might contain database tools, and so forth.

A welcome find for those needing more control over file management is DeskMan/2 1.51a (list price,$79.95; from Development Technologies, 803-790-9230). DeskMan/2 has an expanded file manager and advanced file security (for example, you can prohibit specific users from deleting, viewing, or even finding specific files). It also supports animated icons and up to 81 virtual desktops.

Another OS/2 file manager—a commercial implementation of a popular shareware package—is FileStar/2, Version 1.0 (list price, $69.95; from SofTouch Systems, 800-944-3028405-947-8085). FileStar/2 is a complete file-management package, allowing files to be displayed by several methods (filenames, icons, et al) as well as providing several filters for specific file viewing (you can sort by date, time, or attribute). And like any good OS/2 application, it supports drag-and-drop of files between directories and drives. Further, FileStar/2 does some basic system maintenance, such as monitoring available memory and the size of OS/2 system swap space.

SofTouch also sells GammaTech Utilities for OS/2 3.0 (list price, $99), a suite of 22 utilities. Some of these—particularly those dealing with the OS/2 file system—are must-have items: GammaTech Utilities will undelete deleted files, clean up corrupted HPFS volumes, and optimize both HPFS and FAT partitions. The package lets you customize your system configuration by reconstructing and editing boot sectors. Finally, there's a utility that totally erases data for those worried about security issues. If you buy one utility package, this should be the one.

Moving files between an OS/2 machine and personal computers running other operating systems (like DOS, Unix, and Windows 3.1) is a task made simpler with LinkWiz (list price, $149; from PCX; 619-259-6300). Under OS/2 and Windows 3.1, you can use drag-and-drop to move files between machines. LinkWiz will also synchronize directories on different machines.and serve as an OS/2 duplicator.

A less extensive and less expensive utility package is OS/2 Essentials (list price, $39.95; from Stardock Systems, 313-453-0328). Essentials is actually a collection of six utilities: DirMaster (a file manager), FileBar (which places a menu bar on the top or bottom of the screen), FileGraph/PM (which charts available disk space), Havoc (a game), ScreenSaver (just what the name suggests), and Icon Library (ditto). □

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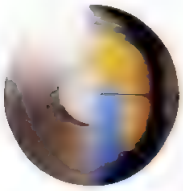

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THE WINDOWS 95

UPGRADE CLINIC

Your transition from Windows 3.1 to Windows 95 should be smooth, but there are still plenty of tricks you need to know. Our Windows experts share their secrets.

By Don Willmott

In this section of our special Microsoft Windows 95 coverage, we give you our favorite tips and tricks for upgrading to Windows 95 and for taking advantage of its new interface. There's a lot for you to learn, but if you're upgrading, the time spent will be worthwhile.

If you're a typical Windows user with adequate hardware, upgrading to Windows 95 shouldn't be too difficult, especially if you're not connected to a network. Even if you are a LAN user, though, it has never been easier to get an operating system up and running. In "Your New OS and Your Peripherals: The Driver Manual," which follows this section, we present a complete list of current peripheral drivers so you can tell whether you should upgrade them as you upgrade the OS.

Spend just 10 minutes with Windows 95 and you'll be convinced that it's much more than an incremental upgrade to the interface of Microsoft Windows 3.1. You'll also be convinced that you will need a little time before you fully understand what is going on.

Microsoft says that its usability testing shows that most Windows 3.1 users can accomplish all their typical tasks just as fast or

We hope you have half as much fun as we did.

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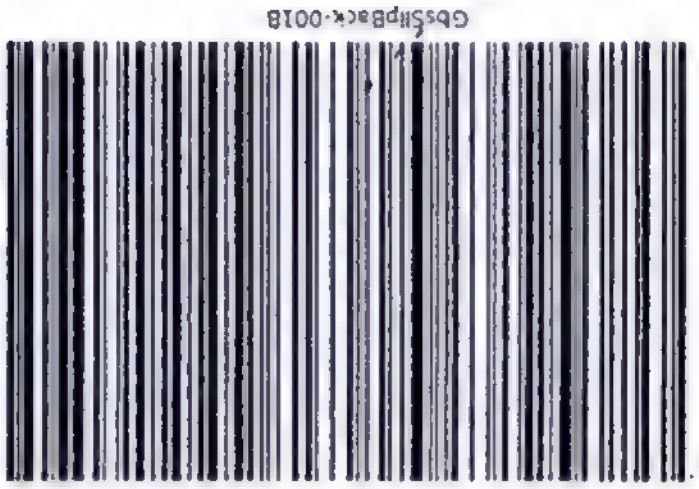
The Microsoft® Windows® 95 operating system is here. And so is a whole new generation of software and hardware designed to help you get the most out of your PC. Just look for products with the Designed for Windows 95 logo. If you can handle any more excitement, check out our online launch event starting August 24th at **http://www.windows.microsoft.com** where you can learn even more about Windows 95.



Back

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Inverted Back

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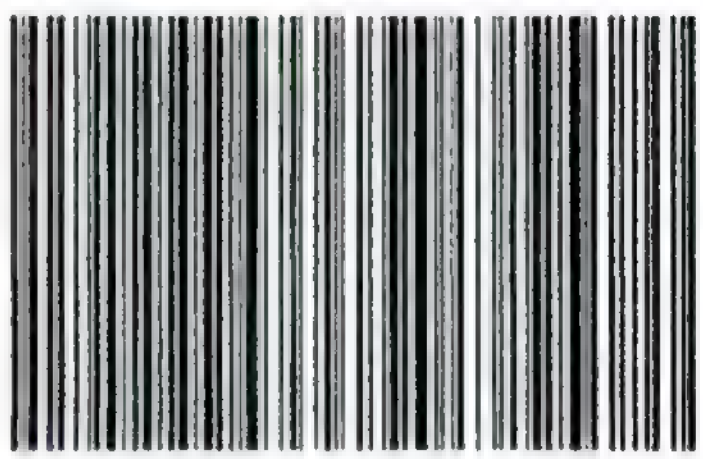

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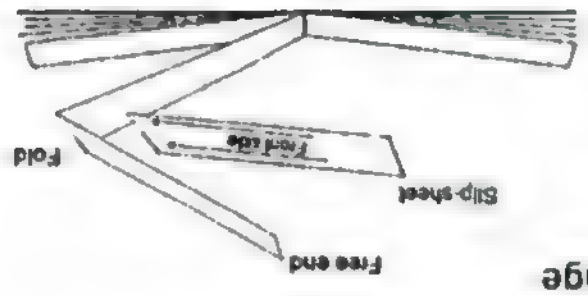
3. Slice the folded edge
4. Close the page and slip-sheet



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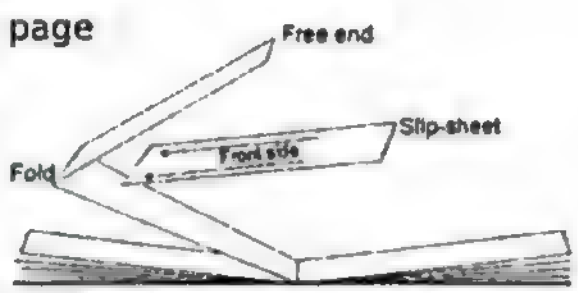

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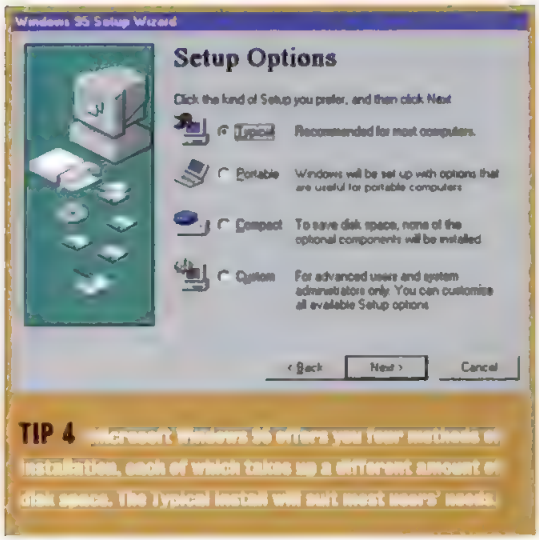
faster in Windows 95 after just 2 hours of practice and a peek at the tutorial. Even if you take a bit longer than that, your efforts will pay off. Many of Windows 95's interface improvements have been designed with plain common sense in mind (and, to some extent, with the Macintosh in mind). In fact, some of the new interface conveniences may be hard for you to learn because they're incredibly intuitive and you've spent the past ten years learning how to cope with interfaces that are inherently counterintuitive. As a Windows user, you've been trained to expect a culture of complexity. Those days are finally fading away.

INSTALLATION TIPS

1. Do a common-sense cleanup first. Don't install Windows 95 until you take a good, hard look at your hard disk and clean it up. Delete or archive old files and apps. Run a complete defragmentation with a defragger you trust. Make your system lean and mean before you install Windows 95. Consider backing up your essential files, just in case. These include all the .INI files, .DAT files, and .PWL files in your Windows directory. They also include your AUTOEXEC.BAT and CONFIG.SYS files and any files specified within them, as well as network configuration files and log-on scripts. Better safe than sorry.—*Don Willmott*



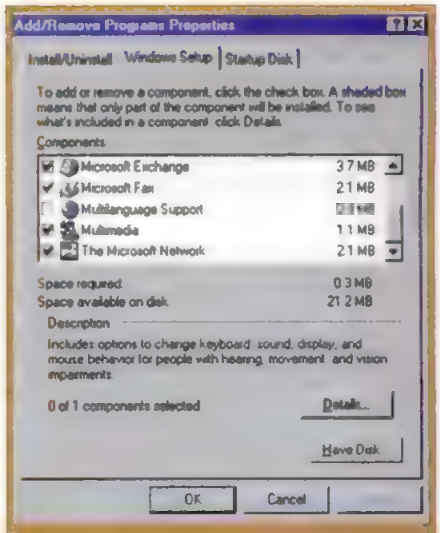
TIP 4 Microsoft Windows 95 offers you four methods of installation, each of which takes up a different amount of disk space. The Typical install will suit most users' needs.

2. Make room for Windows 95. Our experience tells us that you need to have at least 41MB of hard disk space, despite Microsoft's lower estimate. You'll probably need closer to 60MB for a successful Windows 95 installation experience because it is a big OS and because temp files that take up a good amount of space are created during the installation process. A full installation of every Windows 95 component takes 75MB. Setup takes a while to analyze your disk, so you can waste 5 to 10 minutes if you don't start with enough available space.—*Craig Ellison*

3. Decide whether to overwrite Windows 3.1. Windows 95 gives you the chance to overwrite Windows 3.1. Think twice before doing so. You may find that the device driver for one of your peripherals or one of your software applications isn't compatible. Consider installing Windows 95 to a separate directory and then reinstalling your software in Windows 95. Even though this will take longer, it's a way of guaranteeing that all your current apps will run well under the new OS.—*DW*

4. When in doubt, choose the typical installation. Of the four installations from which you can choose—Typical, Portable, Compact, and Custom—it's easiest to go with the typical installation. This is especially true if you install from a CD-ROM, because anything else you want to install later will be easily accessible. There's no more of that annoying search for disk number nine.—*DW*

5. Don't run QEMM. You can't have Quarterdeck Office Systems' QEMM memory manager (or, more specifically, its DOS-UP feature) running during the installation. QEMM prevents the setup program from detecting all of your hardware components. In fact, you should make sure that no TSRs are running when you start your Windows 95 installation.—*CE*



TIP 11 The Add/Remove Programs dialog box makes it easy to customize Windows 95 after the initial installation.

6. Don't run Highscan. If you're running EMM386.EXE, you must not run Highscan. Like QEMM, it also prevents the setup program from detecting all of your hardware components successfully.—*CE*

7. Do run Real-mode drivers. Network and multimedia Real-mode drivers must be running for the setup program to have a chance of finding all your hardware successfully.—*CE*

8. Consider installing Quick View. The new Quick View utility isn't a standard component of typical Windows installations because it takes a few MB of disk space, but it can be a real time-saver (just use the Add/Remove Programs dialog box). With Quick View installed, you can right-click on most common types of files and view them immediately.—*DW*

9. Remember, you can uninstall Windows 95. You *can* uninstall Windows 95. To do so, you must choose "Save system files" during setup. It's always nice to

Our Contributors: ROBIN RASKIN is editor of *PC Magazine*. DON WILLMOTT is an executive editor of *PC Magazine*. THOMAS MACE is a senior editor of *PC Magazine*. LANCE ULANOFF is an associate editor of *PC Magazine*. CRAIG ELLISON is system support manager of *PC Magazine*. EDWARD MENDELSON, JEFF PROSISE, STEVE RIGNEY, BARRY SIMON, and CRAIG STINSON are contributing editors of *PC Magazine*. BEN Z. GOTTESMAN is a technical director of PC Magazine Labs. EARLE ROBINSON is a frequent contributor to *PC Magazine*.

know you can go back if something goes wrong.—*Robin Raskin*

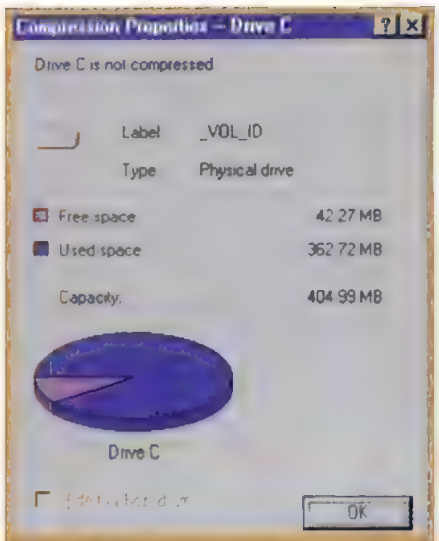
10. Start up in troubleshooting mode. If Windows 95 isn't running right, try starting the OS up while bypassing your system files. As your PC starts up, it displays the message "Starting Windows." When you see that message, hit F8. You get a menu of several start-up choices that give you different ways of getting into the system. One of them may prove helpful in troubleshooting your problem.—*DW*

11. Install new operating system components after setup. If, after installing Windows 95, you decide you'd like to add one or more of the optional components you skipped the first time, select Control Panel from the Start/Settings menu (each is an option that will let you go to the next), double-click on Add/Remove Programs, and click the Windows Setup tab in the ensuing property sheet. There you will find a list of optional components similar to the one displayed during a custom install. Check the components you wish to install and click OK a few times to add them to your system.—*Jeff Prosise*

12. Use DriveSpace to increase storage efficiency. If you have a large hard disk (500MB or greater) and it is partitioned as one volume, you can lose up to 50 percent of your disk space to inefficiencies in Windows 95's VFAT file system. (For an explanation of why this occurs, see *PC Magazine*'s Tutor column of June 27, 1995.) One way to beat the VFAT system is to compress your hard disk with Windows 95's DriveSpace utility. In addition to expanding your hard disk's storage capacity through on-the-fly compression, DriveSpace minimizes the disk space that is wasted between the end of each file and the file's final allocation unit.—*JP*

13. Use DriveSpace3 in lieu of DriveSpace on large hard disks. DriveSpace won't handle compressed drives larger than 512MB. In order to compress a 1GB drive without breaking it up into several smaller drives, use the DriveSpace3 compression utility featured only on the optional Microsoft Plus! CD-ROM. DriveSpace3 also delivers higher compression ratios if your system is fast enough to handle the additional processing overhead.—*JP*

14. Keep your DOS manuals. There is some help in Windows 95 for DOS commands that follow the latest syntax but very little for older drivers that you may have loaded (such as RAMDRIVE.SYS). Keep your DOS manuals on a shelf somewhere. You may be glad you did.—*Earle Robinson*



TIP 12 For the first time, Windows includes a disk-compression utility, DriveSpace, and a disk defragmenter as well.

15. Consider buying a UPS. Windows 95's memory and resource management is great, but remember that when you have a lot of memory, the cache is dynamic, not fixed as it was under Windows 3.1. If you suffer a power outage you may have quite a bit of data in memory that hasn't yet been written to disk. The large dynamic cache is also a reason to avoid disabling synchronous buffer commits.—*ER*

Kinder Error Messages

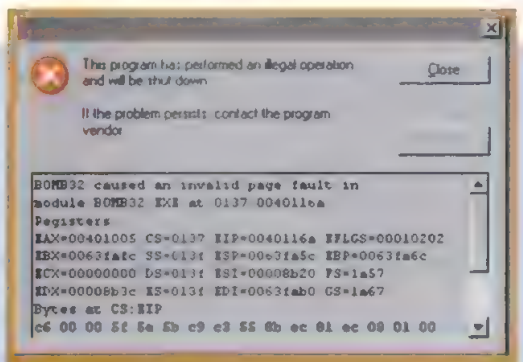
By Thomas Mace

Though a system crash is never a happy moment, Microsoft Windows 95 carries its kinder, gentler interface philosophy to the error messages that appear when things do go south. Whereas Microsoft Windows 3.1 signaled a general protection fault with a stark white window, Windows 95 announces the termination of a misbehaved application in a good-looking gray message box decked out with icons.

More substantively, Windows 95 does a far better job of telling you what went wrong. While Windows 3.1 displayed the name of the crashed module and a single 16-bit address associated with the fault, the Details tab on Windows 95's error-message box provides detailed postmortem information about the computer's state at the time of the crash.

This information includes the type of error, the critical address where the error occurred, the offending program module, the values of the processor registers at the time of the crash, and a hexadecimal stack dump.

More serious violations of system integrity, especially those stemming from a kernel or device-driver fault, typically produce a full-screen character-mode display that lists the offending module and a 32-bit address associated with the crash. Admittedly, this information will not be of much use to anyone unfamiliar with programming, but it can prove invaluable for technical-support calls to the application or driver vendor.



Microsoft Windows 95 traps a page fault and terminates the application. Postmortem information is accessible in the Details tab.

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Making Windows 3.1 Look like Windows 95

By Ben Z. Gottesman

For users worried about switching to Microsoft Windows 95, there's a group of new programs either recently released or on the way that provide Windows 3.*x* with some of the conveniences of Windows 95 or improve Windows 3.*x*'s memory handling.

Kansmen Corp. (408-263-9881) has recently released Do-Over! 1.5. Like Windows 95, Do-Over! lets you change the default screen font and positioning for labels on the title bar. In addition, many standard Windows buttons—such as the Control menu, the Minimize button, and the Maximize button—can be replaced and menus can take on a 3-D look. Kansmen provides many palettes, including ones for IBM's OS/2 Warp and Windows 95. Of greater usefulness is the Do-Bar, which, like the Windows 95 Taskbar, lists all available program groups and shows all open programs. Simply click on the appropriate icon to switch between programs.

Douglas Boling's WinBar, the free *PC Magazine* utility that appears in this issue, gives you quick access to Program Manager groups and all open applications in a bar along the bottom of your screen. For users who would like to sample OS/2 Warp's Workplace Shell, try IBM's freeware, Workplace Shell for Windows (GO WINUTIL on CompuServe).

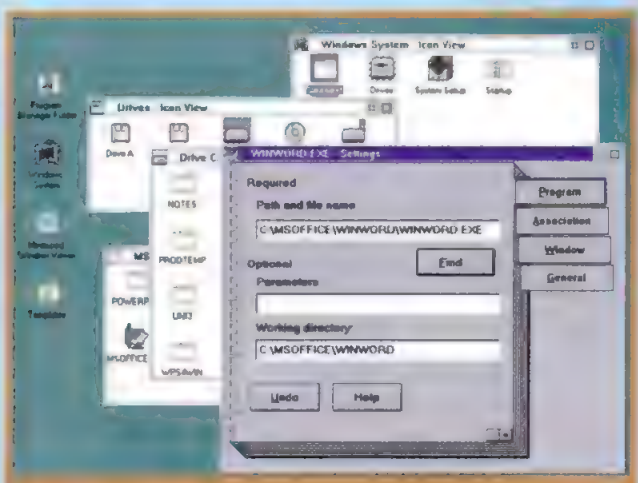
Microsoft Windows 3.0 promised

users access to greater amounts of memory for their applications. Unfortunately, users still ran into "insufficient memory" errors. The two most common causes of these errors are lack of resources (Windows allocates only 64K each to USER.EXE and GDI.EXE to manage such things as Windows icons and fonts) and insufficient conventional memory (although Windows works primarily with extended memory, it continues to use the base 640K for DLLs and applications).

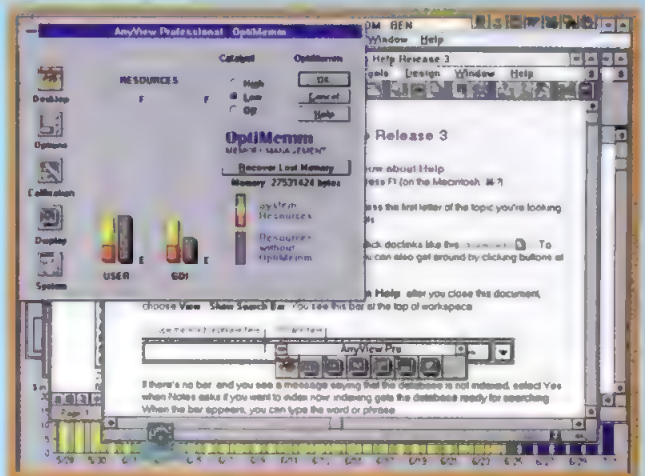
Among the programs designed to improve Windows' overall memory-handling capabilities are Connectix Corp.'s RAM Doubler (800-950-5880, 415-571-5100) and Helix Software Co.'s soon-to-be-released Hurricane (800-451-0551, 718-392-3100). Other programs, such as Landmark Research's MagnaRAM (800-683-6696, 813-443-1331), compress virtual memory, which allows more applications to be launched during a Windows session.

Gamma Research's MoreMem, Analysis and Management Enterprises' Windows Low Memory Saver, and AshbySoft's Memfix all let you allocate small segments of conventional memory for use by Windows applications. This approach also prevents large Windows DLLs from grabbing this same memory and pushes them into the more plentiful extended memory. All of these programs are shareware and are available via CompuServe and several FTP sites on the Internet.

Also worth a look is Binar Graphics' AnyView Professional graphics utility and its included OptiMemm utility, which helps manage Windows resources (800-228-0666, 415-491-1565).

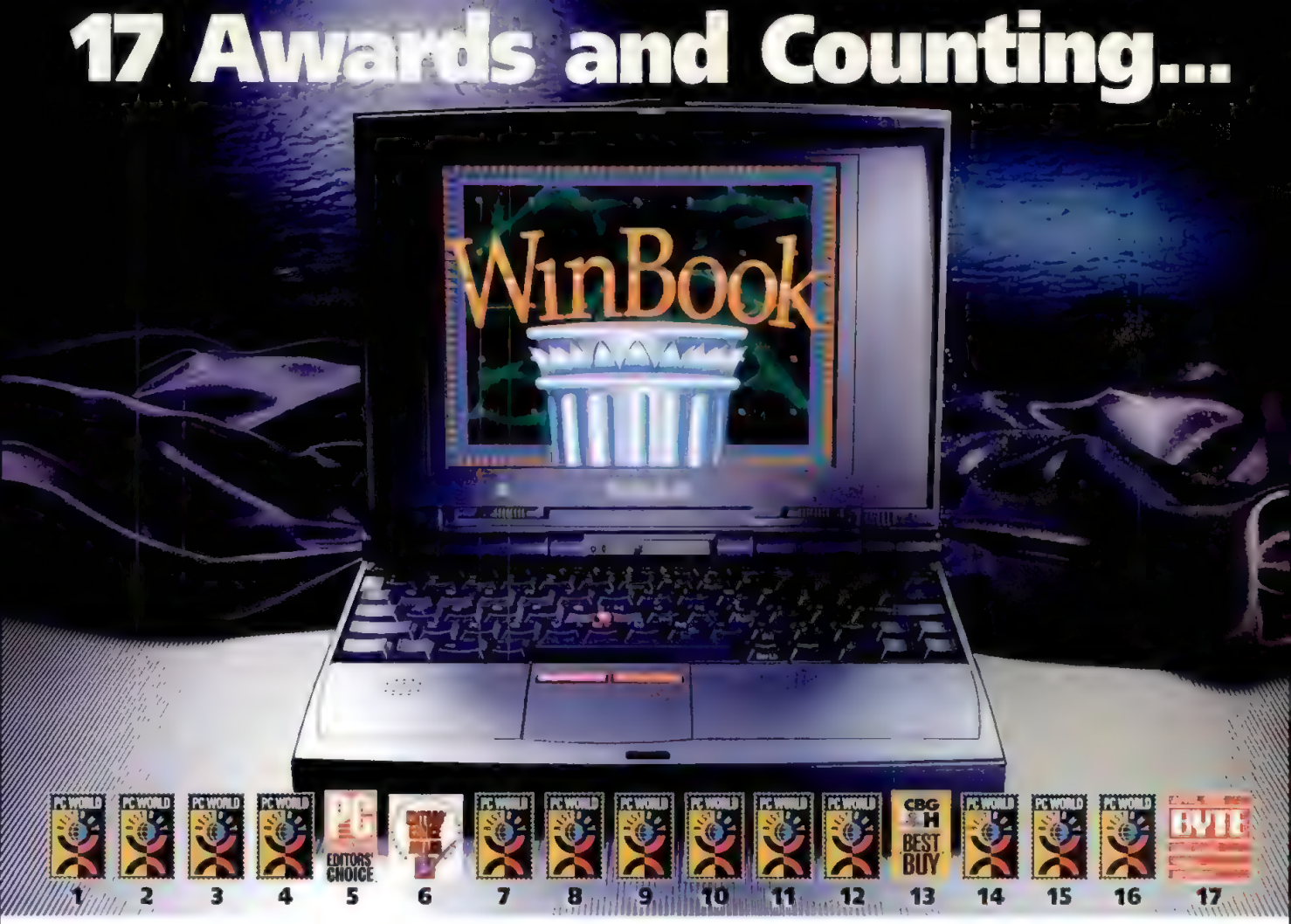


OS/2 Warp's Workplace Shell can sit atop Microsoft Windows 3.1. A version is downloadable for free from CompuServe.



AnyView Professional, from Binar Graphics, includes a useful memory maximizer called OptiMemm.

17 Awards and Counting...



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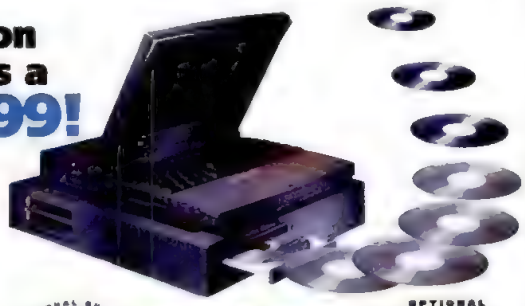

intel inside

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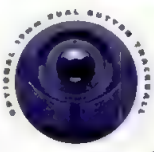

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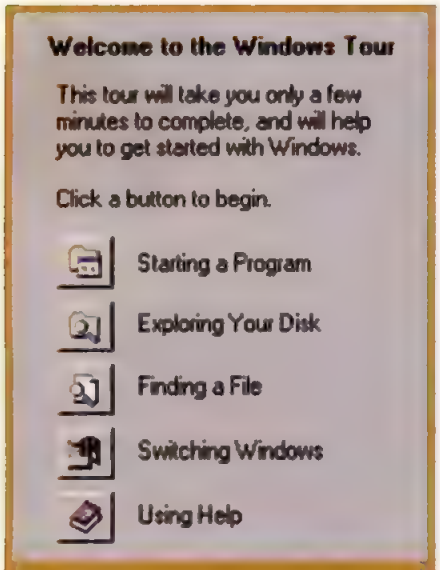
INTERFACE TIPS

16. Use the new help system. Microsoft has pumped up the help in Windows 95, starting with a 10-minute tour that teaches you the most basic points about the new interface. There is also a troubleshooting guide, a good collection of tips and tricks for navigating the interface,



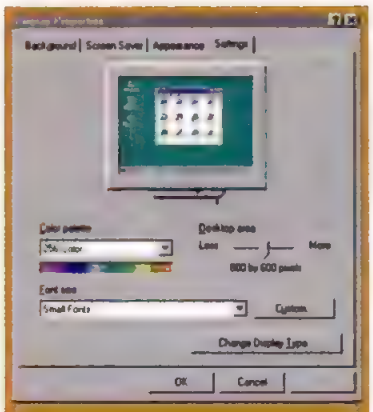
TIP 16 No one ever likes to run through boring tutorials, but the quick tours that come with Windows 95 are worth the effort.

and some questions and answers for Windows 3.1 users who want to know how to do things they're used to doing.—*DW*

17. What is that little question mark? The question mark in the upper-right-hand corner of many dialog boxes is the What's This button. Click on it and drag the question mark to anything you don't understand. You'll get a pop-up explanation. —*DW*

18. Right-click everywhere. After ten years, Microsoft has finally given you a reason to get familiar with your right mouse button, and after a few months, you'll be *really* familiar with it. Click the right mouse button no matter where you are, and something is bound to happen. In most cases, the right mouse button gives you some kind of information about the properties of the item your mouse is pointing at, whether the item is the screen itself, a file, a folder, or even the Taskbar.—*DW*

19. Note what hasn't changed. The Ctrl-Esc key combination still works. Now it brings up the Start menu rather than the task manager. Alt-Tab still works for switching among apps. In fact, the task-switching menu now looks even better than before.—*DW*



TIP 18 Right-clicking on almost anything gets you some kind of Properties menu.

20. Use fast keyboard shortcuts. Pressing Backspace opens the folder that is one level higher than the folder you're currently in. Alt-Enter gives you the properties of the currently highlighted item. Shift-F10 is the keyboard equivalent of clicking the right mouse button.—*DW*

21. Customize the Taskbar: Move it or lose it. You can simply drag the Taskbar to any edge of your display. You can also hide it by going to Start/Settings/Taskbar and clicking on the Autohide option. If you right-click on a blank spot in the Taskbar you can minimize or tile all your currently open items.—*DW*

22. Create your own Start menu. You can add programs to the Start menu by going to Start/Settings/Taskbar/Start Menu programs/ and adding programs from there. Or you can drag group windows to the Start menu by dragging them from the desktop to the Start button. You can also drag .EXE files from My Computer or Explorer directly onto the Start button or you can drag them into a folder under the Windows folder called Start Menu.—*DW*

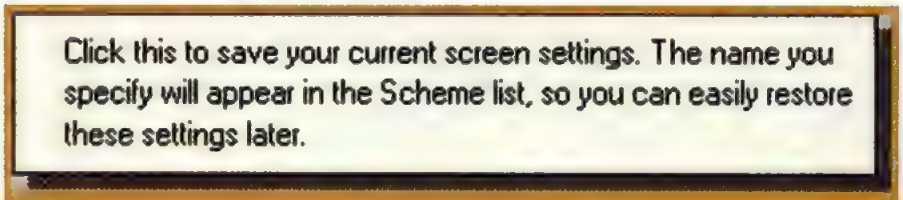
23. Give multiple users multiple settings. If several users are going to use the same PC, each can have their own Windows settings. Under Settings/Passwords, each user can pick a password and define the settings he or she wants to use. —*Barry Simon*

24. Browse folders using a single window. You can eliminate the multiple windows that open when you browse through My Computer by selecting View/Options from the menu in the My Computer window and clicking the single-window button.—*JP*

25. Close those folders. In My Computer, drilling down into a series of nested folders can leave a mess of open windows on your desktop. To close them all at once, hold down the Shift key as you click on the Close button of the last folder. All the folders will close at the same time. Hitting the Backspace key will take you to the folder that's one level above where you currently are.—*DW*

26. Use the Run command to open folders. The Run command on the Start menu isn't just for running files. You can use it to pop open a folder, too, just by typing in the name of the folder. This is often quicker than navigating through folder windows or Explorer windows, and the drop-down history list makes access to all your regular folders easy. —*Craig Stinson*

27. Keep file extensions visible. If you want to be able to view the file extensions for all of your files, click on the View menu under Explorer, and select Options.



TIP 17 Many dialog boxes now have a question mark in the upper-right-hand corner. Click on it, and when you point at something you don't understand, pop-up help offers an explanation.

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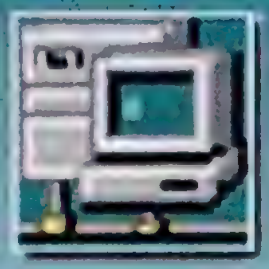

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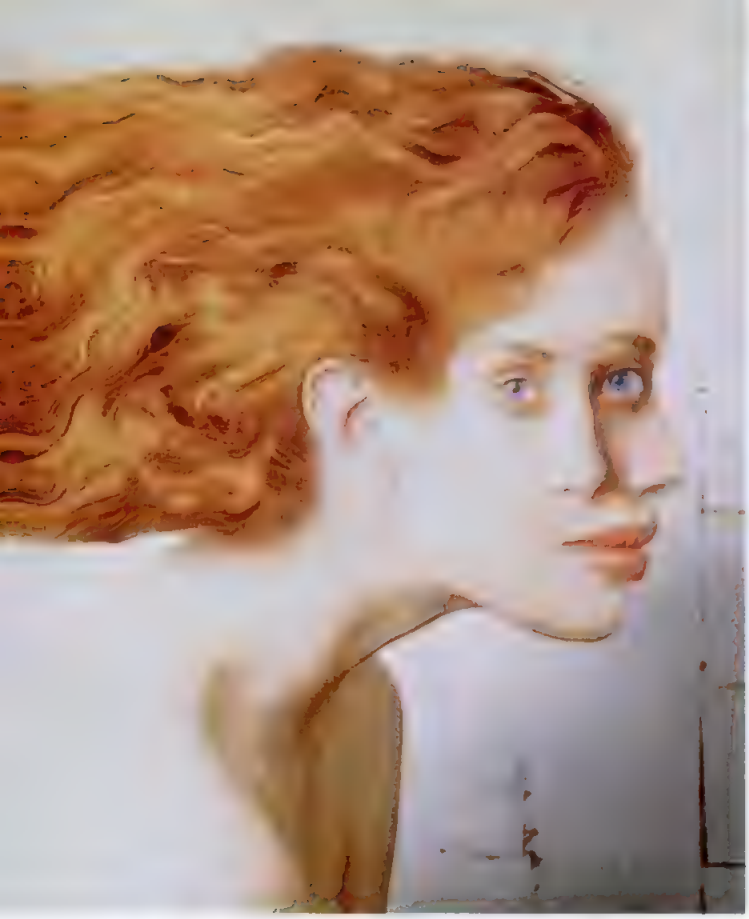

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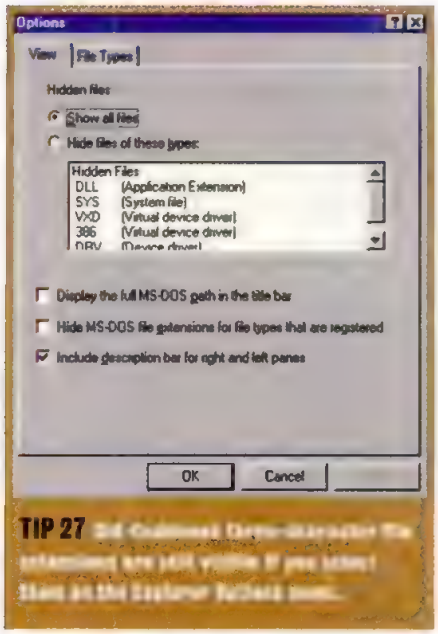
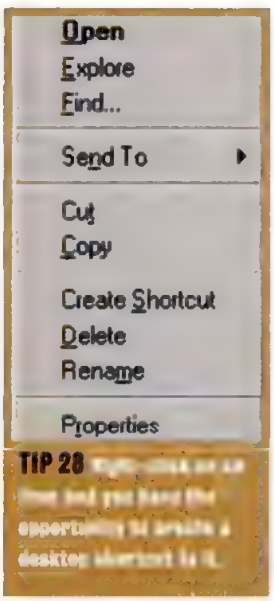


A tabbed dialog box will appear; select View. Then deselect the second check box from the bottom, which is labeled: "Hide MS-DOS file extensions for file types that are registered." All your file extensions will appear next to their filenames as soon as you hit OK or Apply at the bottom of the dialog box.—*Lance Ulanoff*

28. Right-click on any item to create a shortcut to it. Making shortcuts to frequently used folders and files is one of Windows 95's best interface improvements. Once you have a system of shortcuts designed, your Windows navigation will really speed up.—*DW*



29. Drag pieces of data onto the desktop. You can create a "scrap" of data simply by highlighting it in your application and dragging it onto the desktop. Turning the scrap into a shortcut also makes it into a quasi-bookmark, effectively giving you one-click access to any point in a long document. Another way to use scraps is as Post-It notes to yourself. Just pop open WordPad, type a note, and drag the note to the desktop. Read the note later just by clicking on the note. —*DW*

30. Put printers on the desktop. Sure you can put files and applications on the desktop, but you can also put printers there. Just go to My Computer, look at your printer icons, pick the ones you want instant access to, and then create a shortcut and drop it on the desktop. Then all you have to do to print a file in a Windows app is drag the file to and drop the file on the printer icon.—*DW*

31. Make shortcuts to The Microsoft Network. If you use The Microsoft Network, you can create a shortcut to any location you find useful simply by dragging the icon for the forum or newsgroup you like to the desktop. Click on it later and MSN will fire up and take you right there.—*Edward Mendelson*

32. Make shortcuts to directories. You can build shortcuts to your favorite or most-used directories by typing in the path under Windows 95's Run button under Start on the Taskbar. Just type in the path, hit Return, and Windows 95 will automatically map to the drive and location and pop up a window for the drive that contains all its directories and subdirectories. —*LU*

33. Make shortcuts to anything. Nothing will speed up your Windows work faster than your mastery of shortcuts. We've just seen how you can create a shortcut to a printer or a location on The Microsoft Network, but you can also create shortcuts to directories and folders. These shortcuts will give you a simple way to copy and move files around your PC or around a network without having to open and close windows in Explorer or My Computer constantly.—*Thomas Mace*

34. Create a Mac-like desktop. For a Macintosh-like desktop that displays drive icons, create shortcuts for all the drives in My Computer and place them on the desktop. The drive icons make handy drop targets, and you can now format a floppy disk in drive A: by right-clicking the drive icon and selecting Format from the Context menu.—*JP*

35. Change the name of My Computer. Some Windows 95 power users may find the phrase My Computer a bit precious. No problem. To change it, just bring up Explorer, move the highlight to My Computer, and hit F2. Now you can change the name to whatever you want.—*ER*

36. Teach Windows not to say "shortcut." If you delete the words "shortcut to" from the shortcuts that you create, Windows 95 will eventually realize what you're doing, and it will no longer put those two words on your shortcuts. That will save desktop space, too. —*DW*

this is how

Windows 95 and your brain

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Windows 95 Support: Whatever Suits You Best

By Robin Raskin

Microsoft Corp. has been ramping up its technical-support efforts in preparation for Microsoft Windows 95. There's an entire smorgasbord of options, but which one suits you best?

FOR THE ON-LINE SAVVY

The on-line services America Online, CompuServe, the Internet, and The Microsoft Network all have a base level of support that includes seven-day-a-week, 24-hour-a-day access to the Microsoft KnowledgeBase.

America Online (keyword MICROSOFT) has neither forums nor BBS components. CompuServe (GO MICROSOFT) has a high-profile BBS with plenty of action. To get support via the World-Wide Web, go to *http://www.microsoft.com*. You can also gopher to *gopher://gopher.microsoft.com* or FTP to *ftp://ftp.microsoft.com*.

The Microsoft Network, Microsoft's homegrown on-line service (click on Computers & Software/Microsoft Information Booth), takes tech support to the most logical extension by allowing Microsoft's support staff to include things such as shortcuts and objects as a part of the BBS. The member-to-member message activity was high during beta testing and postings drill down to areas such as video drivers and Plug-and-Play. WinNews, a chat room, and the Windows KnowledgeBase are also available here. You can turn this menu selection into a shortcut on your Windows 95 desktop, which makes it really convenient to access. During prerelease, though, we found The Microsoft Network to be the most sluggish service of all.

For those who want the most direct line to Microsoft: Set your modem to 2,400 or 9,600 bits per second, no parity, 8 data bits, and 1-bit stop. Then call 206-936-6735. You'll be able to download device drivers, bug fixes, and other goodies to help you over the hurdles.

FOR NEWS JUNKIES

If you want to know what's happening with Windows 95, you can browse WinNews. You'll find white papers, press releases, and other Microsoft-related topics delivered in mercifully concise newsletter style. To get there via:

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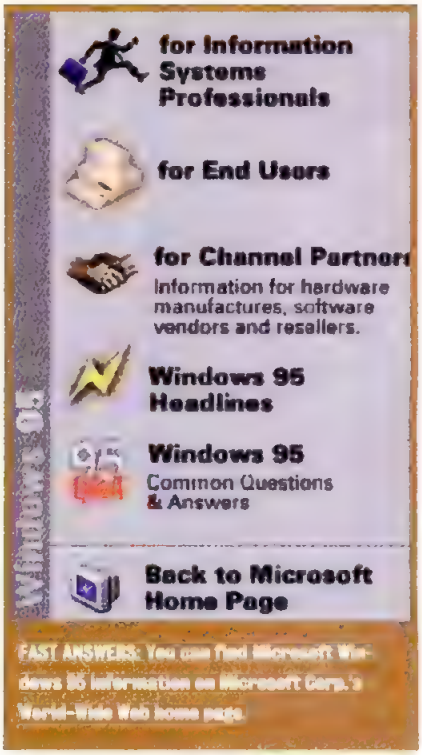
FOR TELEPHONE USERS

Windows 95 help is just a phone call away. The toll number is 206-635-7000, and it's available from 9:00 A.M. to 9:00 P.M. eastern time, excluding holidays. When you call Microsoft in those early, free encounters, you won't know whether you're actually reaching Microsoft or any one of five outsourcers. After 90 days, the outsourcers will contact you about their long-term, fee-based support. The fee-based support will cost $30 per call and will be available 24 hours a day.

You can assume that after the first 90 days of seamless support, the outsourcers will scurry to establish niche support markets. Outsourcers include Digital Equipment Corp. (800-430-5411) and Unisys Corp. (800-874-8647), which is already well known for its services aimed at large corporate customers and its knowledge of corporate-migration issues. Stream (800-298-8214) and Softmart (800-337-6904), two resellers, are geared toward small and medium-size organizations. Keane (800-459-4695) is a pure services provider and may be best suited for home users.



FOR TOUCH-TONE FANS

Microsoft FastTips provides a list of answers to frequently asked questions (800-936-4200). Answers are either faxed or mailed to you. This is another around-the-clock service that requires only a Touch-tone phone for access. A caution: Don't even attempt to use FastTips unless you order the FastTips Map and Catalog from the service first. A simple walk through the menus can take an exasperating 5 minutes.

Another source of Windows 95 information: Microsoft's TechNet CD, a $295-per-year subscription disk whose August issue features 2,600 pages of Windows 95 material (800-344-2121).

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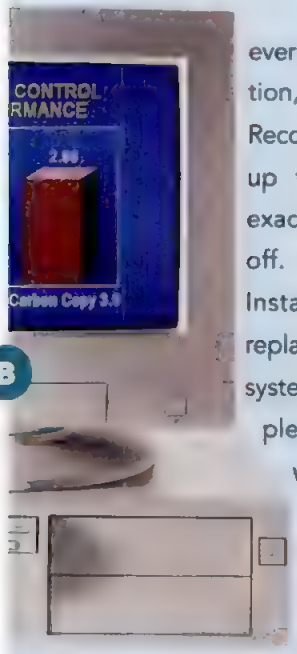

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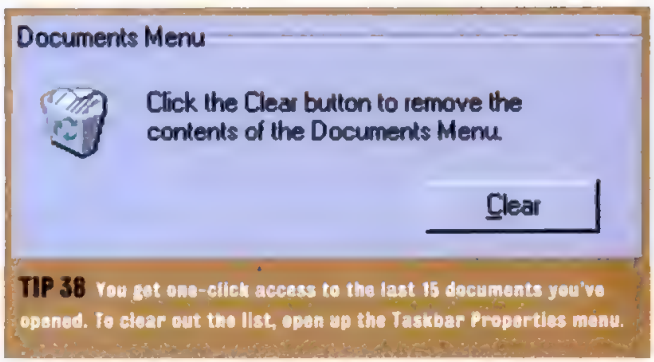
37. Think about documents, not applications. To create a new file from a registered document type, don't start the associated application. Instead, go to the folder where you want the document to reside (use the desktop if you like), right-click and select New from the Context menu, choose the document type, and type the document's filename. To edit the document's contents, open it by double-clicking the document icon or selecting Open from the icon's Context menu. As a bonus, the document will now appear in the Start menu's list of recently used documents so you'll have easy access to it later on.—*JP*

38. Prune the Start menu's document list. To speed access to recently edited documents, Windows 95 lists the documents that you've recently worked on under Start/Documents. If the list grows too cluttered and you find yourself taking too much time to scan the document names, clear the list by right-clicking the Taskbar, selecting Properties, clicking the Start Menu Programs tab, and pressing the Clear button.—*JP*



TIP 38 You get one-click access to the last 15 documents you've opened. To clear out the list, open up the Taskbar Properties menu.

39. Start programs in minimized or maximized format. If you use your right mouse button to click on the Start button, you'll get a menu. Pick Open, and you'll see icons for the programs in your Start menu. Choose one, click Files/Properties, pick the Shortcut tab, and you can set the program to start up in minimized or maximized format.—*DW*

40. Drag files from Explorer onto the desktop. An alternative to creating shortcuts to files is to bring the files right onto

Windows 95: The LAN Manager's Checklist

By Craig Ellison and Steve Rigney

1. Check the client PC's hardware configuration. Before installing Microsoft Windows 95 on a networked PC, make sure that the network adapter is set up correctly. If the PC is currently running network software there shouldn't be a problem, but if it's a new network installation you need to double-check your settings. For example, most network adapters use a combination of a hardware interrupt, DMAs, an I/O address, and memory addresses. If your network adapter is using a setting that's already in use by another internal peripheral—such as a sound card—Windows 95 won't work with the cards, and in some instances the installation will fail.

2. Check the software, too. Whenever you install a new operating system on a networked PC, clean up the configuration files, including AUTOEXEC.BAT, CONFIG.SYS, and all of the Windows .INI files by removing TSRs, DOS-based screen savers, and other potential troublemakers. (In your .INI files, remove optional mouse, keyboard, and video drivers, too.) If you're loading several different device drivers, including backup schedulers and screen savers, the Windows 95 installation may not finish successfully.

Windows 95 also doesn't work with some common device drivers, including Quarterdeck Office Systems' QEMM and even Microsoft's own EMM386, if you use the Highscan parameter. Setup warns you that it may be unable to identify hardware. Unfortunately, these conflicts don't appear until you are 5 to 10 minutes into the installation. If you do encounter conflicts, Windows 95 installation could take several tries and several hours.

You should only load the drivers that are necessary to start your PC and install Windows 95. You will need to load your CD-ROM drivers if you are installing from a CD and your network-adapter drivers if you want Windows 95 to detect your network adapter successfully.

3. Choose your server. Windows 95 includes two types of network clients and two types of servers. The clients include the client for Novell's NetWare networks and the one for Microsoft networks. The NetWare client lets you connect your DOS- and Windows-based NetWare clients to any PC running Windows 95. Note that although the DOS and Windows PCs can connect to Windows 95, your Windows 95 PCs can't connect to your NetWare clients.

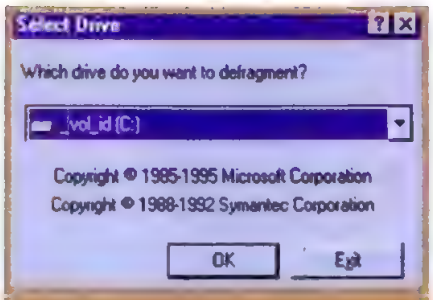
The Windows services let you create a peer-to-peer network between your PCs running Microsoft Windows for Workgroups, Microsoft Windows NT, and Windows 95. Unlike the NetWare network services, the Windows network service is a true peer-to-peer network. Unfortunately, you can only install one service on your PC at a time.

4. Choose your network client. Windows 95 includes several 32-bit network client drivers for different networks including Banyan Systems' VINES, FTP's NFS, NetWare, SunSoft's PC-NFS, and Windows NT. Before you can connect to a network

the desktop and leave them there. You can drag files from Explorer, or from My Computer, onto the desktop. To stay organized, put files in folders.—*DW*

41. Copy and paste files. You're already used to cutting, copying, and pasting bits of data. Now, to move or copy files, you can use the same cut, copy, and paste commands, just as you did with data under Windows 3.1.—*DW*

42. Group-select files displayed by the shell. To select a group of files quickly in a folder or on the desktop, drag a selection rectangle around the files by holding down the left mouse button. To add files to the group whose icons don't fall within the rectangle, click the file icons with the Ctrl key depressed.—*JP*



TIP 45 The hard-to-find data-compression and disk-defragmentation utilities are at Start/Programs/Accessories/SysTools.

43. Take advantage of the printer icon in the Taskbar. To check the status of a print job or to pause or resume printing quickly, double-click the printer icon that Windows 95 displays in the Taskbar when a print job is spooling to the printer.—*JP*

44. See Taskbar text in full. To view the full text of a program button in the Taskbar, move the mouse pointer to the button and let it hover for half a second or so. A small tooltip window will appear with the full text of the item—for example, "Microsoft Word—1995 Art and Editorial Budget" rather than "Microsoft Word—199..." Tooltips are used throughout Windows 95 to clarify the meanings of push buttons and other user-interface objects; try this and see for yourself.—*JP*

45. Dig down to the disk utilities. The hard-to-find data-compression and disk-defragmentation utilities are located at Start/Programs/Access/SysTools.—*DW*

46. Reserve disk space for extra memory. Under Settings/Control Panel/System,

server, you must install the correct network client software. You may also need to configure the client software with the correct server or domain name, IP address, and user name and password.

If Windows 95 doesn't include a 32-bit client for your network, you can use any third-party Real-mode Windows driver. Unlike with the network services, you can install as many network clients as you need. Windows 95's network will work using the IPX, NetBEUI, and TCP/IP protocols.

5. Make your connections. After you have installed and configured the operating system, network server, and network client, you are ready to connect to the network. You can use either the Network Neighborhood or the Explorer utility to browse and connect to the servers on your LAN or across your WAN. You can access the network resources by selecting the server icon or you can map a drive letter to the network volume. You can also set up the client for NetWare networks to enable NetWare login-script processing to set up your drive mappings and printer captures.

Windows 95 cannot load most third-party TSRs from a command in your login script. If you need to load any TSRs, you'll need to call these files from your AUTOEXEC.BAT file or load them manually.

6. Check your network performance. Windows 95 includes a utility called System Monitor that will help you troubleshoot performance on your clients and servers. It lets you view dozens of different performance statistics for your CPU, hard disk, memory, and network adapter. In addition to monitoring your local PC's performance, you can connect to another Windows 95 PC and use System Monitor to monitor all of your network servers. You can only monitor one PC at a time and you must enable password-level security on every PC you want to control.

7. Monitor network connections. The Net Watcher utility in Windows 95 is a good tool to use to troubleshoot network performance and monitor network usage. It lets you see which users are connected to a particular server and the files they are accessing. You can even use Net Watcher to disconnect a user from a server. If a user complains of slow performance, both Net Watcher and System Monitor will let you connect to that PC and monitor local and network performance from a remote location.

8. Troubleshoot after the installation. If you add or remove hardware and software after the initial Windows 95 installation, you may encounter problems. For example, if you install a CD-ROM drive and the installation changes your last drive statement in your CONFIG.SYS file, you won't be able to access any network drives after you restart your PC. To eliminate these problems, always use the Install New Hardware wizard when you add hardware and always make a backup of all your configuration files.

9. Return to DOS when necessary. To boot a client PC to the version of DOS that was present before you installed Windows 95, use the multiboot feature. In every system's root directory, there is a hidden file named MSDOS.SYS. Using the Attrib command, remove the hidden, system, and read-only flags from the file. Using a text editor, add the following line under the Options section:

BootMulti=1.

To use the multiboot feature, hit F8 when Windows 95 starts, and an additional option, "Start using previous version of MS-DOS," will be on the menu.

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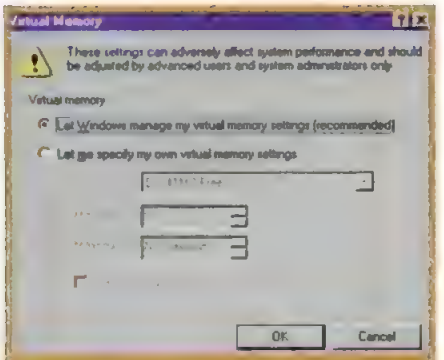


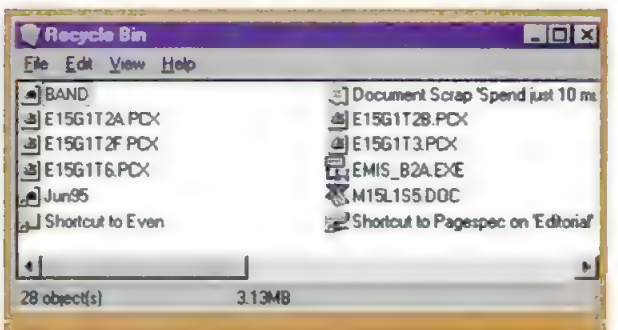
TIP 46 Windows 95 gives you the opportunity to manage virtual memory by hand, but it's better to let Windows 95 handle this.

you can alter the amount of virtual memory you use. This tip is for power users only. In most cases, it's a good idea to let Windows 95 manage your virtual memory dynamically.—*DW*

47. Recycling is not deleting. When you drag an item into the Recycle Bin, it isn't deleted. To delete an item completely, you must empty the Recycle Bin. To bypass the Recycle Bin when you delete an item, hold down the Shift key while you hit Del.—*DW*

48. Watch what you recycle. Remember, when an actual file is sitting on your desktop, it isn't the same thing as a shortcut to a file. Recycle a file, and it's gone. Recycle a shortcut, and only that pointer to the file is gone. The file itself still exists.—*DW*

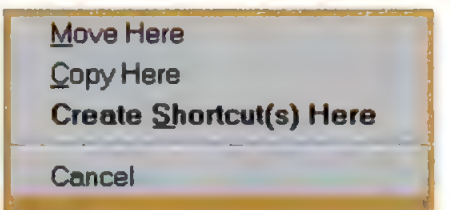
49. Right-drag till you drop. When you drag a program file from one Explorer window to another, Explorer will copy or move the file depending on the windows and file type involved. It tries to be as clever as it can but it can't always guess what you want. If you press the right mouse button (rather than the left button) and drag, when you drop the file, you get a menu of choices. The default choice is highlighted so you can learn for the future. This paradigm is used through the shell and will be widely used in applications.—*BS*



TIP 48 Files and items you "recycle" aren't deleted unless you clear out the Recycle Bin.

50. Give the mouse a rest. Despite what you've read elsewhere, you can use keyboard shortcuts for every feature in Windows 95. Press Shift-F10 to bring up the right-click menu on any object. Or press Alt-Enter to go directly to the Properties dialog box. If you want to use the arrow keys to move the mouse cursor, go to the Accessibility options in Control Panel, go to the Mouse tab, and turn on MouseKeys.—*EM*

51. Customize the mouse. Settings for the mouse are located under Settings/Control Panel. Note that for the mouse as well as for many other peripherals that can have multiple settings, Windows 95 lets you save several different *schemes* among which you can switch at will.—*DW*



TIP 49 When you drag a file using the right mouse button, you get a menu of options.

52. Copy or move in one Explorer window. If you're used to File Manager, you'll probably open two Explorer windows to copy or move files: one for the source directory and one for the destination. You can get by with one if you are in Explorer (with the directory tree on the left side of the window). Just open the source directory, scroll the tree so the destination is in view, and drag from the file pane to the destination directory on the tree. You'll need to be careful to expand the tree so the destination directory is exposed before opening the source directory.—*BS*

53. Keep a window open to DOS. You can keep a small DOS window open and use it as a command line for launching Windows applications. If you launch them by typing the start command, they'll open in their own window.—*TM*

54. Note that SUBST is back. SUBST, a useful aliasing tool for directories, was introduced with DOS 3.1, but Microsoft dumped it in Windows for Workgroups, saying that SUBST could not perform 32-bit file handling. But now it's back in Windows 95. You don't even need to define SUBST directories in the AUTOEXEC.BAT file. They can be created from any DOS session running inside Windows 95 and they are instantaneously visible to Explorer.—*ER*

55. Allocate all resources to DOS. If you need to give a DOS application lots of resources, go to My Computer, click on the icon for the program, go to the File menu, click on Properties, and on the Program tab, click Advanced and then MS-DOS Mode.—*DW*

56. Optimize DOS programs that you run. There is no .PIF editor in Windows 95. To optimize a DOS program, go to My Computer and click on the icon for the program. Go to File/Properties and specify the settings you want. To specify whether the app runs full-screen or in a window, change the Run properties on the Program tab. —*DW*

57. Copy text from a DOS window. You can copy and paste text from a DOS window into a Windows application running under Windows 95. In a DOS window, click on the DOS icon, point to Edit, and then click Mark. Click at the beginning of the text you want to copy. Press and hold down the Shift key, clicking at the end of the text. Then click on the DOS icon, click Edit, and click Copy. Move the cursor to the location you want the text to go, and then click on Edit/Paste. You can't paste text into a DOS window or DOS-based program when the window is running full-screen.—*DW*

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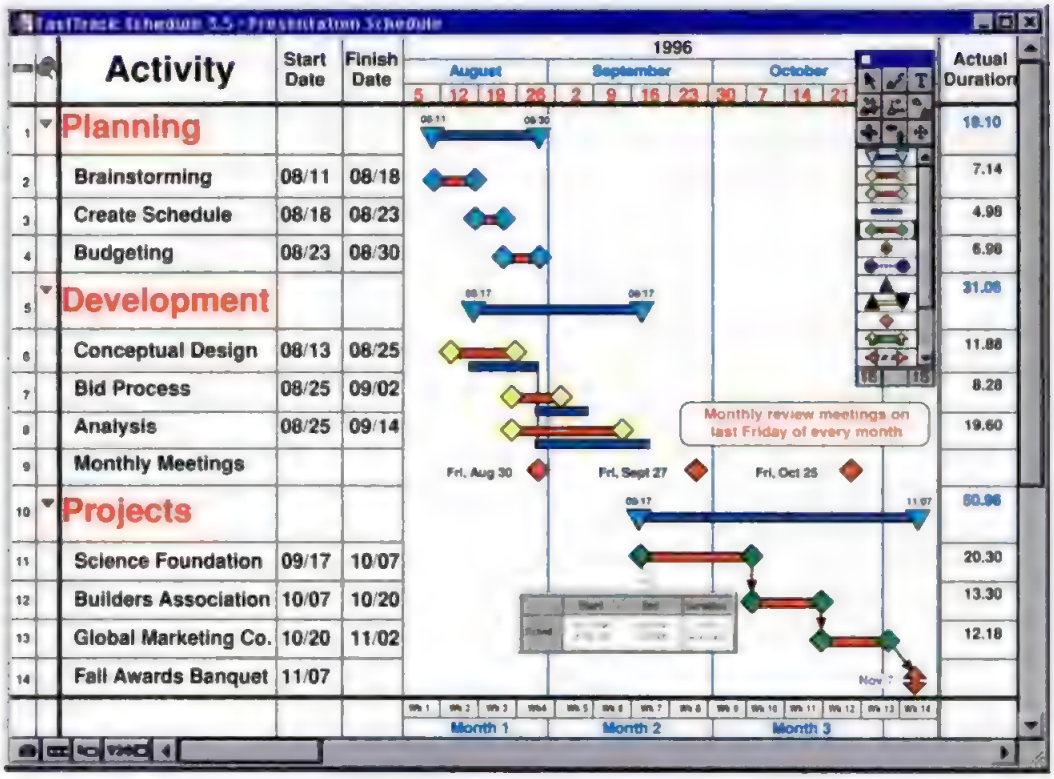

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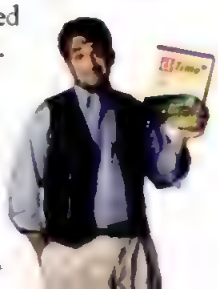

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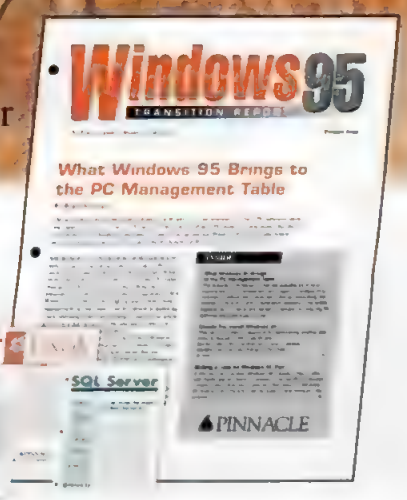

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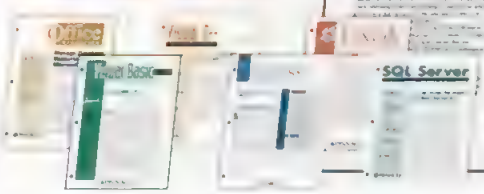

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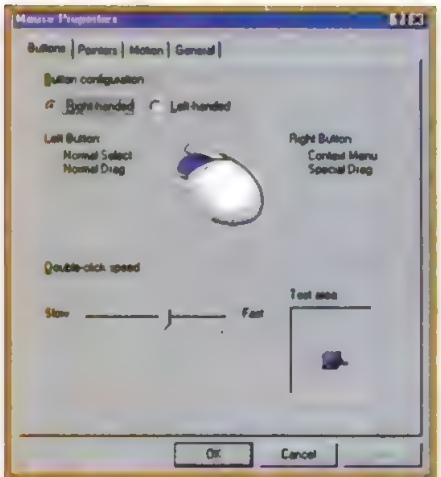
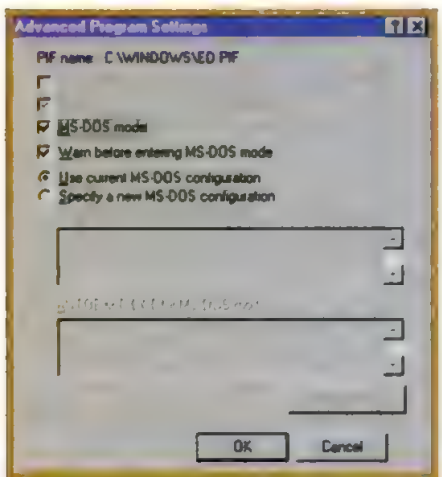


TIP 51 Customization options for the mouse and other peripherals are mainly located in the Control Panel.

58. Jump up the directory tree. In a DOS window, you can use new shortcuts to move up the tree two or three steps at a time. In earlier versions of DOS, you could move up one directory by typing "CD . ."—that's two dots after the CD. Now you can jump two directories by using three dots, or three directories using four dots. You can use the same number of dots in place of a typed-out directory name when you enter a command at the DOS prompt.—*EM*

59. Remember what runs. While the Run command on the Taskbar will automatically find 32-bit applications (they're in the Registry with their paths), it won't automatically find older programs. You have to provide the path.—*ER*



TIP 55 If you're still using a resource-hungry DOS app (perhaps a game), you can assign the app all available resources.

60. Execute global searches. The Find Files and Folders dialog box from the Start menu can be used to search across all your hard disks. Press the arrow next to "Look in:" and scroll up to My Computer and select it. The search will be done on all drives, including those network drives mapped to letters.—*BS*

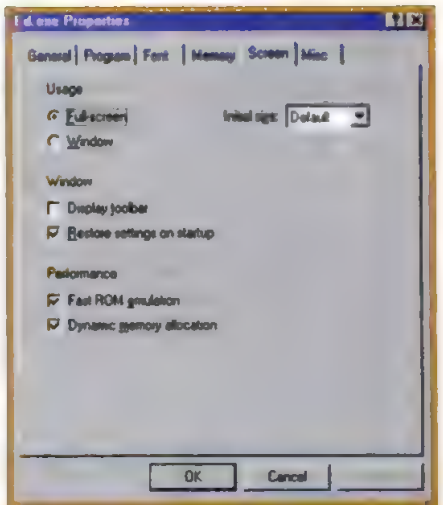
61. Keep the gray keys alive. Various character-based DOS programs use the gray Plus and Minus keys for navigation and other purposes. These keys don't work under Windows 95 unless you use this trick: In the program's Properties menu, on the Screen tab, turn off "Fast ROM emulation." You get the gray keys' functions back.—*EM*

62. Get back to the desktop without the mouse. There's a way to use keystrokes to get your cursor back to the desktop. Ctrl-Esc brings up the Start menu. From there, hit Esc and then Shift-Tab. Note that the highlight is now on the desktop.—*EM*

63. Make Explorer look like Program Manager, Part I. You may like the Program Manager interface of Windows 3.*x* but feel obliged to move to Explorer. Here's how to set up an Explorer window to act much the way Program Manager does, giving you the best of both worlds.

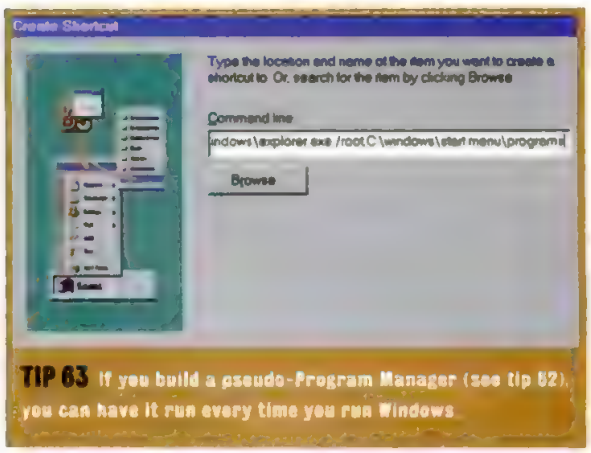
Right-click on the desktop, pick New, and then pick Shortcut from the menu that pops up. This will invoke the Create Shortcut wizard. At the command line, type in "C:\windows\explorer.exe /root,C:\windows\startmenu\programs". Click Next and type in the name you want—for example, "My Progman"—and then click Finish.

Now double-click on the resulting item, click the View menu, and make sure that "Toolbar" and "Status Bar" are unchecked and that there is a dot next to "Large Icons." When you exit, these options will be remembered for this shortcut only and not for other independent Explorer sessions.—*BS*



TIP 61 DOS apps that use the gray keys on the right side of the keyboard as navigation keys can still use them in Windows 95.

64. Make Explorer look like Program Manager, Part II. You can right-click on the icon you've just created with the instructions in the tip above and choose Properties to change the icon and assign a hotkey to it. By dragging it to the directory C:\Windows\Start Menu\Programs\Startup, you can have this pseudo Program Manager start every time you run Windows 95.—*BS*



TIP 63 If you build a pseudo-Program Manager (see tip 62), you can have it run every time you run Windows.

65. Make Explorer look like Program Manager, Part III. Here's another way to get Program Manager–like functionality out of Windows 95. Open the Settings panel for the Taskbar (either by choosing Start/Settings/Taskbar or by right-clicking on the Taskbar), go to the Start Menu Programs tab, choose Advanced, and then, from the Explorer window that

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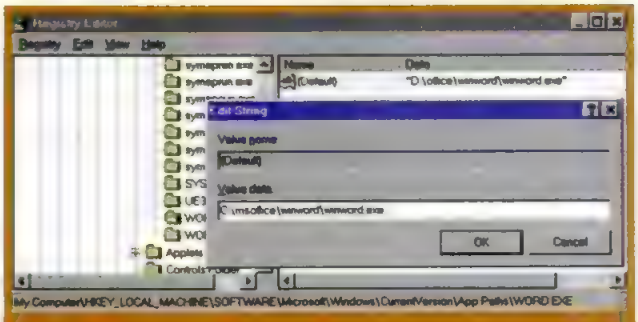


TIP 68 You can create aliases for programs that aren't in your global path. You have to enter the Registry and run regedit

opens, right-drag the Programs item to the desktop. You'll end up with a Programs group on your desktop, with nested groups inside it.—*EM*

66. Revive the real Program Manager. If you really want the true original Program Manager, edit SYSTEM.INI in Notepad and change the line shell=progman.exe. The next time you start Windows, you'll get a sleeker-looking equivalent of the Windows 3.1 Program Manager on your screen, with no Taskbar. Unlike the Program Manager–style interfaces that you can create under the standard Windows 95 interface, groups can't be nested, so all your Taskbar submenus will appear as separate groups. You'll even get a File Manager icon that opens Explorer in a format that looks like the old File Manager.—*EM*

67. Run multiple communications programs. You may have discovered that if you start up a communications program in Windows 95, dial, hang up, and leave the application running while you call up a second communications program, that second program won't dial the modem.

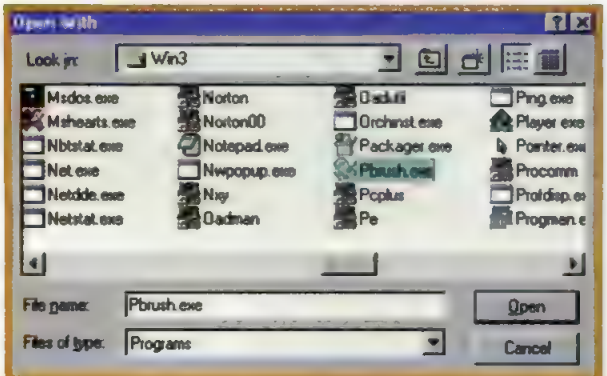
This is Windows 95's default behavior, but there's a workaround. Load SYSTEM.INI into an editor, go to the section called [386Enh], and add a line that reads "com1autoassign=2". If your modem is on port 2 instead of port 1, replace the "com1" with "com2". Note there is only one *m* in "com."

Windows 3.*x* had an entry like this but 2 was the default value. The default changed for a reason. In case you are running a fax modem on auto-answer for receipt of faxes, Microsoft recommends against this setting and has chosen the new default to be the one that people who are receiving faxes will want. —*BS*

68. Define aliases. If you want to define aliases for the Run command line for programs that aren't in your global path, you can use the feature of Windows 95 called "application-specific paths." You'll need to edit the Registry, so be careful. As an example, suppose that WINWORD.EXE is in C:\msoffice\winword and you'd like it to run if you type "Word" in the Start menu run box.

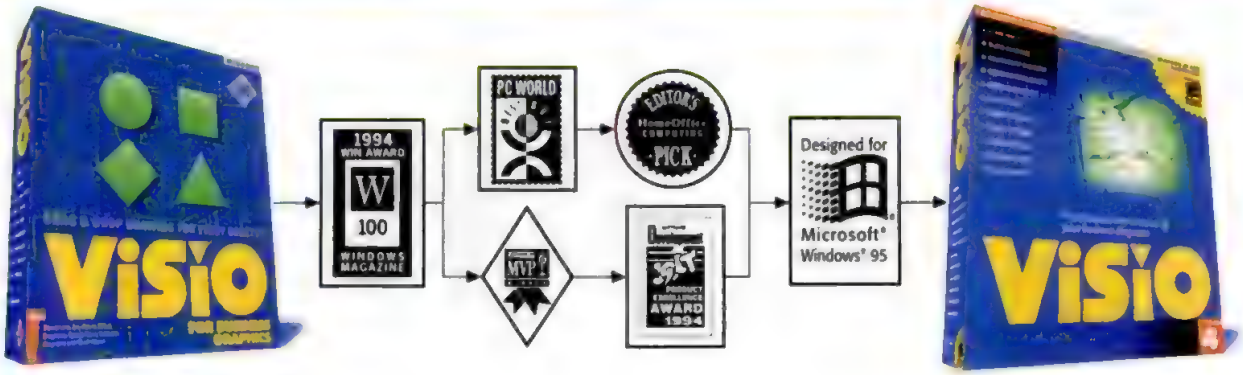
Run regedit. You'll need to find the node of the tree called HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\AppPaths. That isn't as bad as it seems; the node is in a tree structure, so you can click your way through.

Go to the Edit menu and choose New/Key. It will add a subnode called "NewKey #1" selected for you to type in the new name—call it "WORD.EXE."



TIP 69 Windows 95 assigns files to the appropriate applications, but you can change the assignments through Explorer

Now double-click on the word *default* in the right-hand window (or single-click and choose Modify from the Edit menu) and in the resulting dialog box type in "C:\msoffice\winword\winword.exe." That will do the trick.—*BS*



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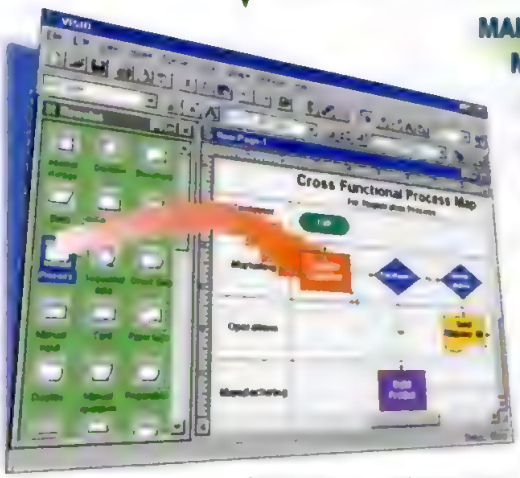

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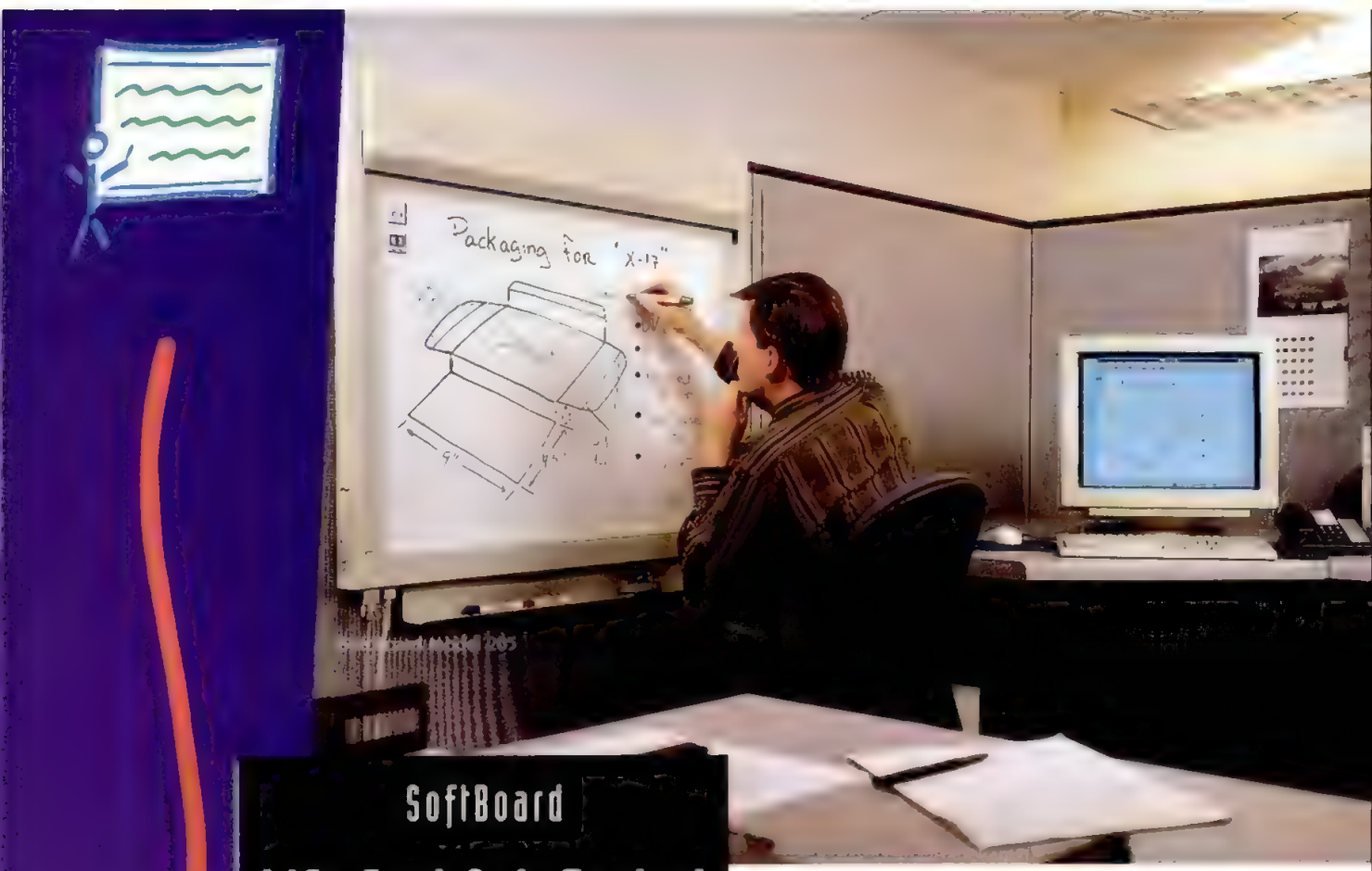

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69. Associate files with apps. If you want to change a file association for a specific file type under Windows 95, you can do so through Explorer. Select Options, found on the View menu. From the tabbed dialog box, select File Types. Then select the type of file you want to work with. Then click on the Edit button. Another dialog box appears. The bottom half of the box lists the kind of actions, such as "open" and "print," associated with the file type. Select the one you want to change. Next, select the Edit button. This dialog box displays the current executable associated with the file type. If you know the new one and the location, you can simply type in the executable. Otherwise, hit the Browse key. A file dialog box named Open With appears. From here, you can select the executable or application you want to use to open this kind of file any time you double-click on it under Explorer.—*LU*

Have fun experimenting. Set aside some specific files that you don't care too much about, give yourself time, and start playing.

70. Set aside time and files for experimentation. Learning Windows 95's new interface is a matter of trial and error. To eliminate the fears of making fatal errors and wasting valuable work time, set aside some specific files that you don't care too much about, give yourself time, and start playing. Be sure to do this before you begin setting up your desktop the way you're really going to want it to look. Create folders, drag files, make shortcuts, cut out scraps, delete and undelete desktop items. Change your mouse settings and change them back. Explore the new utilities. Alter the look of your desktop. Feel your way around for a couple of hours, and the interface will suddenly start to make sense.—*DW* □

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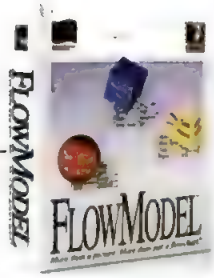

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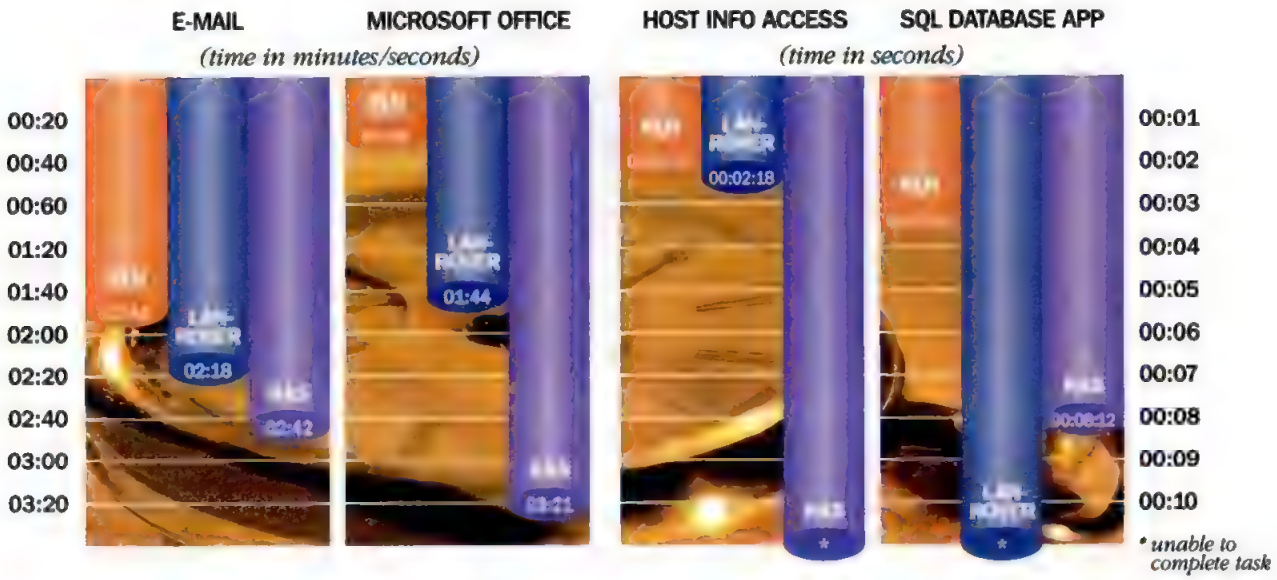

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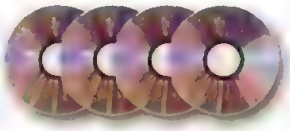

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CIRCLE 115 ON READER SERVICE CARD

YOUR NEW OS AND YOUR PERIPHERALS

THE DRIVER MANUAL

It's the ultimate blind date: How will Windows 95 get along with your preexisting hardware? Will your printer, CD-ROM drive, and graphics card coexist with the new OS in harmony? Are you going to need new drivers for your peripherals, or will the ones provided in Windows 95 do the job?

Not every driver issue has to become a well of suffering. Windows 3.1's UNIDRV—the driver for which printer vendors began writing tables in 1992—proved there's an easier way to support the myriad models available in any hardware category. Windows 95 takes this metaphor a step further to include modems, SCSI cards, and to some extent graphics cards. In each case, Windows 95 introduces a universal or "miniport" driver to interface between the peripheral and the OS. A vendor needs only to provide a list of commands that will add specific variations on top of the general-purpose driver.

The following tables address the compatibility and functionality of products released since January 1993 from more than 130 vendors. Information is divided into six categories: graphics accelerator cards, printers, modems, CD-ROM drives, sound cards, and SCSI cards. We also indicate whether vendors include driver support for Windows NT and OS/2 Warp.

Five of the tables here are preceded by visual guides on how to install new hardware devices and the drivers that support them. Combine these tours with the tables and you will have some idea as to how the first date between Windows 95 and your system will go—and who's going to pick up the check.

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Graphics Accelerator Cards 338
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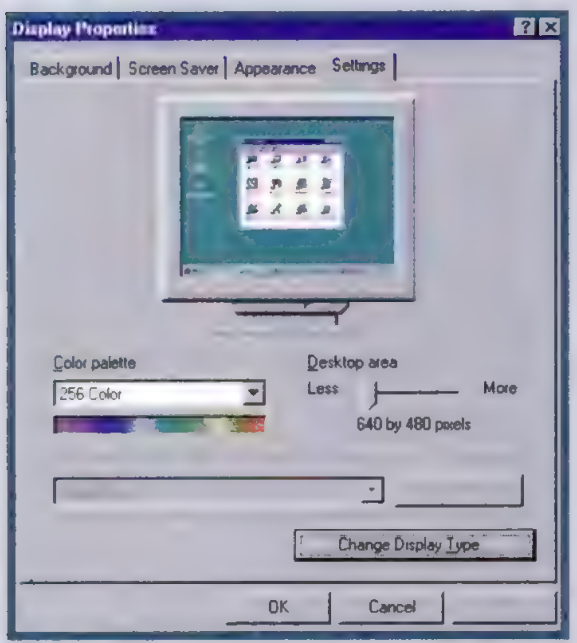
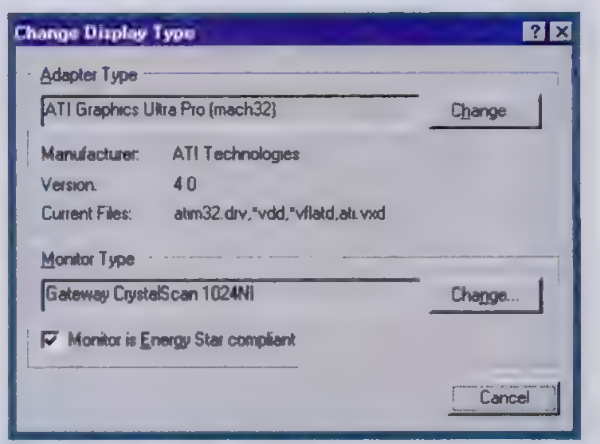
SCSI Cards 474

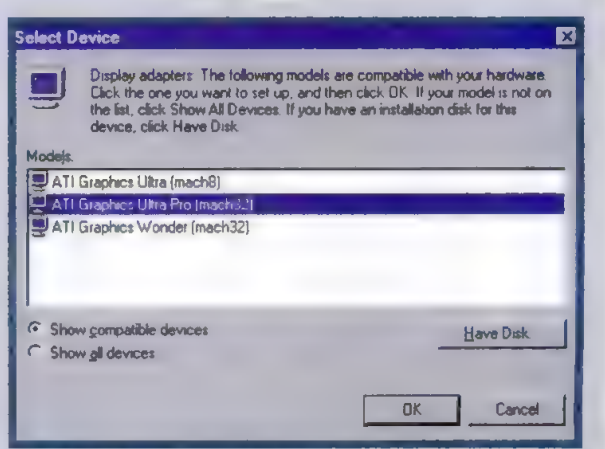
Graphics Accelerator Cards



1 In addition to offering a unified-display properties-control dialog box (shown above), Windows 95 also lets you change your graphics accelerator card—or simply check which one is installed—by clicking the Change Display Type button.



2 This dialog box describes the graphics card, driver files, and monitor type currently configured for your machine. To change adapter types or install a new one, click on the Change button next to the Adapter type box.



3 A list of preinstalled compatible devices (and their drivers, although the filenames are not listed) appears in the Select Device dialog box. You can select one of these or install a new one using the Have Disk button.

Whether you have an older, unaccelerated graphics-display card or one of the newer boards with a graphics controller, you can expect to find under Windows 95 many improvements and features in the area of graphics display.

Besides providing greater stability, Microsoft has performed lots of core development work to assure compatibility with the older breed of boards (and boards no longer in production). Microsoft has designed a "minidriver" architecture that graphics card vendors can use to make their products work with Windows 95.

What makes this possible is the combination of Windows 95's 32-bit device-independent bitmap (DIB) engine and the universal-display driver. The DIB engine specifically takes advantage of 32-bit features offered in 386 and 486 CPUs and renders Windows GDI calls—such as a call that results in the movement of memory bitmaps—with enhanced speed. The universal driver supports the device-dependent code, written by the board vendor in the minidriver, which communicates directly with the low-level circuitry in the hardware. Microsoft claims that an unaccelerated Super VGA board running in 256-color mode could perform up to 90 percent faster than it would under Windows 3.*x*, which had little optimized operating-system–level support for the display adapter.

Many graphics card vendors will choose to bypass the minidriver architecture completely in favor of writing "full-blown" display drivers for their newest products. Also look for simpler and more consistent-looking software for installing and configuring your board.

If the display driver is corrupted or incompatible with Windows 95, Windows is now smart enough to launch you into a compatible VGA mode after you restart your computer.—*Jeff Mace*

Our Contributors: ERYN BROWN and CADE METZ are editorial researchers at *PC Magazine*. LANCE ULANOFF was the associate editor in charge of this story, and JEFF MACE was the project leader.

THE DRIVER MANUAL

Graphics Accelerator Cards

All tables compiled by Eryn Brown and Cade Metz

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
Actix Systems Inc. Phone, [illegible] 1625 fax, 40[illegible] 1546 BBS, 40[illegible] 970 3719	[illegible] S3 801	Ver 2 4	Yes No	Yes	N/A	[illegible] (BBS)	Ver 1 11	[illegible]
	GraphicsEngine 32, S3 805	Ver 2 4	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1 11	Ver 2 52
	GraphicsEngine 32 VL, S3 805	Ver 2 4G	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1 11	Ver 2 52
	GraphicsEngine 64, S3 864	Ver 1.28P	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver 1.11	Ver. 2 52
	GraphicsEngine 64+, S3 Trio	Ver 1 424	No Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.11	Ver 2.52
	GraphicsEngine Ultra, S3 928	Ver 2 4G	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1 11	Ver 2 52
	GraphicsEngine Ultra 64, S3 968	Ver 1 0R	No Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.11	Ver. 2 52
	GraphicsEngine Ultra 64 AV, S3 968	Ver 1 41B2	No Yes	Yes	N/A	No Yes (BBS)	Ver 1 11	Ver 2 52
	Picasso 64, ARK 1000	Ver 1 4	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1 41	Ver 1 41
	Picasso 64, ARK 2000	Ver 2 4	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 2 41	Ver 1 42
	Picasso 64 AV, ARK 2000	Ver 2.4	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 2 41	Ver 1 42
	ProSTAR 64, Cirrus Logic 5434	Ver 1 10D	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1.23	Ver 1 22
	ProSTAR 64 Lite, Cirrus Logic 5430	Ver 1 10L	Yes No	Yes	N/A	Yes Yes (BBS)	Ver 1 23	Ver 1 22
	ProSTAR VL, Cirrus Logic 5428	Ver. 1 53P	Yes No	Yes	N/A	Yes Yes (BBS)	None	Ver 1 43
ATI Technologies Inc. Phone, [illegible] 2500, fax, [illegible] BBS, [illegible] 9404 CompuServe, GO ATITECH; Internet, *ftp atitech.ca*, Web site, *http://www atitech.ca*	[illegible] ATI mach64GX	64WIN151 ZIP	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	64NT150 ZIP	Supported by OS
	Graphics xPression ATI mach64GX	64WIN151 ZIP	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	64NT150 ZIP	Supported by OS
	WinTurbo, ATI mach64GX	64WIN151.ZIP	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	64NT150 ZIP	Supported by OS
Boca Research Inc. Phone, 407 997 6227; fax, 407-997-0918, BBS, 40[illegible] 241-1601 CompuServe, GO BOCA, Internet, *sales@boca.org*; Web site, *http://www boca.org*	Basic VGA, Cirrus Logic 5401	CIRRUS.DRV	Yes No	Yes	N/A	No No	None	Supported by OS
	Boca Voyager, C&T [illegible]	CHIPS DRV	Yes No	Yes	N/A	No No	Supported by OS	Supported by OS
	Boca Voyager 64, S3 Trio 64	S3.DRV	Yes No	Yes	N/A	No No	Supported by OS	Supported by OS
	PCI-Bus SuperX VGA, Cirrus Logic 5430	CIRRUS DRV	Yes No	Yes	N/A	No No	Supported by OS	Supported by OS
	Super VGA, Cirrus Logic 5420	CIRRUS.DRV	Yes No	Yes	N/A	No No	None	Supported by OS
	SuperX VGA, Cirrus Logic 5428	CIRRUS.DRV	Yes No	Yes	N/A	No No	None	Supported by OS
	VL-Bus SuperX VGA, Cirrus Logic 5428	CIRRUS DRV	Yes No	Yes	N/A	No No	None	Supported by OS
Cardexpert Technology Inc. Phone, 510-252-1118; fax, 510-252-9889, BBS, 510-354-3800	V10PCI, ARK 1000PV	Ver 1.4	No Yes	Yes	N/A	Yes Yes (BBS)	Ver 3 5	Ver 3.0
	V18, Cirrus Logic 5420	Ver. 1.30	Yes No	Yes	N/A	Yes Yes (BBS)	None	None
	V20PCI, ARK 2000PV	Ver. 2.4	No Yes (64-bit)	Yes	N/A	Yes Yes (BBS)	Ver. 3.5	Ver 3.0
	V23LBV, UMC 85C418	Ver 0 9	No Yes	Yes	N/A	Yes Yes (BBS)	None	None
	V23VIO, UMC 85C418 and UMC 82C862	Ver 0.9	No Yes	Yes	N/A	Yes Yes (BBS)	None	None
	V24LBV, Cirrus Logic 5424	Ver. 1.32	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver 2 0
	V27LBV, Cirrus Logic 5426	Ver. 1 43	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver. 2 0
	V27TC, Cirrus Logic 5422	Ver. 1.43	Yes No	Yes	N/A	Yes Yes (BBS)	None	Ver 2 0
	V28LBV, Cirrus Logic 5428	Ver 1.43	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver. 3 0
	V30PCI, Cirrus Logic 5430	Ver 1 2	No Yes	Yes	N/A	Yes Yes (BBS)	Ver 3.5	Ver. 3 0
	V33LBV, Western Digital WD 90C33	Not yet released	No Yes	No	None	Yes No	None	None
	V34PCI, Cirrus Logic 5434	Ver. 1.2	No Yes (64-bit)	Yes	N/A	Yes Yes (BBS)	Ver. 3.5	Ver. 3 0
	V35PCI, Avance Logic 2301	Ver 2.0	No Yes	Yes	N/A	Yes Yes (BBS)	None	None
	V40LBV, Tseng ET4000	6/15/93	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver 2 0
	V40-1, Tseng ET4000	6/15/93	Yes No	Yes	N/A	Yes Yes (BBS)	None	Ver 2 0
	V40TC, Tseng ET4000	6/15/93	Yes No	Yes	N/A	Yes Yes (BBS)	None	Ver 2 0
	V41LBV, Tseng ETDriver4000/W32	2/8/95	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver. 2 0

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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Graphics Accelerator Cards

Continues

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	[illegible] ET4000/W32	2/8/95	Yes No	Yes	N/A	Yes Yes (BBS)	None	Ver 2.0
	[illegible] ET4000/W32	2/8/95	No Yes	Yes	N/A	Yes Yes (BBS)	None	Ver 3.0
	[illegible] ET4000/W32p	2/8/95	No Yes	Yes	N/A	Yes Yes (BBS)	Ver 3.5	Ver 3.0
	[illegible] ET4000/W32i	2/8/95	No Yes	Yes	N/A	Yes Yes (BBS)	Ver 3.5	Ver 2.0
Diamond Multimedia Systems Inc [illegible]	Speedstar 24x Western Digital WD2081	Ver 2.04	Yes Yes	No	None	Yes No	Supported by OS	None
	Speedstar 64 Cirrus Logic 5434	Ver 2.04	Yes Yes	No	None	Yes No	None	None
	Speedstar Pro Cirrus Logic 5426	Ver 1.09	Yes Yes	No	None	Yes No	Supported by OS	None
	Speedstar Pro SE Cirrus Logic 5430	Ver 2.04	Yes Yes	No	None	Yes No	None	None
	Stealth64 S3 801	Ver 3.0	Yes Yes	No	None	Yes No	Supported by OS	None
	Stealth64 Trio64 W32p	Ver 1.02	Yes Yes	No	None	Yes No	None	None
	Stealth64 DRAM S3 864 and S3 Trio64	Ver 1.35	Yes Yes	No	None	Yes No	None	Ver 1.04
	Stealth64 Video 2000 S3 Trio64	Ver 2.03	Yes Yes	No	None	Yes No	Ver 1.00	Ver 1.00
	Stealth64 Video 3000 S3 Trio64V+	Ver 2.05	Yes Yes	No	None	Yes No	Ver 1.10	Ver 1.01
	Stealth Pro S3 928	Ver 3.0	Yes Yes	No	None	Yes No	Supported by OS	None
	Stealth SE S3 732	Ver 1.35	Yes Yes	No	None	Yes No	Ver 1.12	Ver 1.00
	Stealth DRAM S3 911 and S3 924	Ver 2.41	Yes Yes	No	None	Yes No	Supported by OS	None
	Viper PCI Weitek P9000 and Weitek P9100	Ver 3.06	Yes Yes	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Ver 1.01
	Viper [illegible] Weitek P160	Ver 2.01	Yes Yes	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Ver 1.12
	Viper SE Weitek P9100	Ver 2.01	Yes Yes	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Ver 1.12
	Viper VLB Weitek P9000	Ver 2.04	Yes Yes	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Ver 1.01
Elitegroup Computer Systems [illegible]	Videoimage VI-650 AT, model 4	S3 DRV	Yes No	No	Win 95 ship date	Yes Yes (BBS)	None	None
	Videoimage VI-711 Cirrus Logic 5426	S3 DRV	Yes No	No	None	No No	None	None
	Videoimage VI-711A, Cirrus Logic 5428	S3 DRV	Yes No	No	None	No No	None	None
	Videoimage VI-717, Cirrus Logic 5430	S3.DRV	Yes No	No	None	No No	None	None
	Videoimage VI-720, Cirrus Logic 5434	S3.DRV	Yes No	No	None	No No	None	None
	Videoimage VI-720A Cirrus Logic 5434	S3 DRV	Yes No	No	None	No No	None	None
	Videoimage VI-930 S3 Trio64	S3 DRV	Yes No	No	None	No No	None	None
	Videoimage VI-935 S3 [illegible]	S3 DRV	Yes No	No	Win 95 ship date	Yes Yes (BBS)	Ver 2.23	Ver 1.0
	Videoimage VI-941A S3 Trio64	S3 DRV	Yes No	No	Win 95 ship date	Yes Yes (BBS)	Ver 1.1	Ver 1.1
	Videoimage VI-941B S3 Trio64	S3 DRV	Yes No	No	Win 95 ship date	Yes Yes (BBS)	Ver 1.1	Ver 1.1
	Videoimage VI-942 S3 Trio64	S3 DRV	Yes No	No	Win 95 ship date	Yes Yes (BBS)	None	None
ELSA Inc [illegible]	[illegible]	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 1000 ELSA ISA [illegible]	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 1000AVI (PCI/VLI), S3 Vision 868	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 1000PRO (PCI/VLI), S3 Vision 864	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 1000Trio (PCI/VLI), S3 Trio 64	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 2000 (EISA/ISA/VLI), S3 928	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver

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Continues

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	Winner 2000PRO PCI VL S3 Vision 964	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
	Winner 2000PRO X PCI, S3 Vision 968	Not named	Yes No	No	Win 95 ship date	No Yes (BBS, CIS)	Windows NT driver	OS/2 driver
Expert Graphics Inc. Phone 404 320 0800 fax 404 315 7645 BBS 404 315 7646 CompuServe 75102,354 Internet info@expertg.com	Rasterex Lazer Board TI 34010	TIGA 2.0 RXV 1.01	Yes No	No	None	No No	None	None
	Rasterex Liberty Board TI 34010	TIGA 2.0 RXV 1.01	Yes No	No	None	No No	None	None
	Rasterex Tracer Board TI 34010	TIGA 2.0 RXV 1.01	Yes No	No	None	No No	None	None
Focus Information Systems Inc. Phone 510 657 2845 fax 510 657 4158 BBS 510 657 9451	Cheetah 26 Cirrus Logic 5426	Not named	No Yes	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Cheetah Plus 34 Cirrus Logic 5434	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Cheetah VL Cirrus Logic 5422 and Cirrus Logic 5424	Not named	No Yes	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Cheetah VLB Cirrus Logic 5428	Not named	No Yes	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Premier 1000PCI VLB ARK 1000PV	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Premier 2000 PCI VLB ARK 2000PV	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Road Runner 864 PCI VLB S3 864	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	Road Runner True 64 PCI VLB S3 Trio64	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
	TrueSpeed W32p PCI VLB Tseng ET4000/W32p	Not named	Yes No	Yes	N/A	Yes Yes (BBS)	Not named	Not named
Genoa Systems Phone 408 432 9090 fax 408 434 0997 BBS 408 943 0437 CompuServe GO GENOA Internet support@genoasys.com Website http://www.genoasys.com	8500 SA Cirrus Logic 5426	WIN VGA24, Ver. 1.7	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8500 VL 20 Cirrus Logic 5426	WIN VGA24, Ver. 2.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8500 VL 20 Cirrus Logic 5426	WIN VGA24, Ver. 2.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8500 VL 28 Cirrus Logic 5428	WIN VGA24, Ver. 2.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8500 VL 29 Cirrus Logic 5429	WIN VGA24, Version 1.1	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8534 VL PCI Cirrus Logic 5434	WIN VGA64, Ver. 1.2	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8600 LA Cirrus Logic 5426 and ESS 488	Audio Graphic, Ver. 1.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8600 VLIO Cirrus Logic 5426 and Appian AD 2	M5 Veloce, Ver. 1.7	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8600 VL PCI Cirrus Logic 5426 and Appian AD 2	M5 Veloce, Ver. 1.7	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8864 VL PCI S3 Vision 864	Phantom 64, Ver. 2.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8900 VL Tseng P32	Phantom32, Ver. 1.4	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8900 VL PCI Tseng P32p	Phantom32 HR+, Ver. 2.1	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	8968 PCI S3 Vision 968	Video Blitz III AV, Ver. 2.1	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	9200 VL, Weitek P9000	Video Blitz, Ver. 1.1	Yes No	No	None	No No	Supported by OS	Supported by OS
	9500 PCI, Weitek P9100	Video Blitz II, Ver. 1.0	Yes No	No	None	No No	Supported by OS	Supported by OS
	MG6100 Cirrus Logic 5434 and C Cube	Gvision, Ver. 1.4	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
Matrox Graphics Inc. Phone 514 969 6300 fax 514 969 6363 BBS 514 685 6008 CompuServe GO MATROX	Hiper VGA S3 911	hiper drv, Ver. 2.10	Yes No	No	None	Yes Yes (BBS, CIS)	Supported by OS	Supported by OS
	Hiper Plus S3 924	hiper drv, Ver. 2.10	Yes No	No	None	Yes Yes (BBS, CIS)	Supported by OS	Supported by OS
	Impression 1024 S3 924	hiper drv, Ver. 2.10	Yes No	No	None	Yes Yes (BBS, CIS)	Supported by OS	Supported by OS
	MGA Ultima MGA 64-bit	MGA8 DRV Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL Ver. 2.10	MGA32 DLL Ver. 2.00
	MGA Impression MGA 64-bit	MGA8 DRV Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL Ver. 2.10	MGA32 DLL Ver. 2.00
	MGA Impression Lite MGA 64-bit	MGA8 DRV Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver. 2.10	MGA32 DLL Ver. 2.00
	MGA Impression Plus MGA 64-bit	MGA8 DRV, Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver. 2.10	MGA32 DLL Ver. 2.00
	MGA Impression Plus 220 MGA 64-bit	MGA8 DRV Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver. 2.10	MGA32 DLL Ver. 2.00
	MGA Impression PRO, MGA 64-bit	MGA8 DRV, Ver. 2.11	Yes No	No	MGA DRV Ver. 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver. 2.10	MGA32 DLL Ver. 2.00

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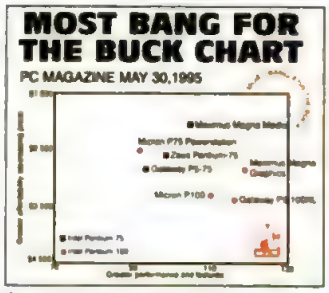

The closer to the upper right corner. From the pages of PC Magazine May 30, 1995

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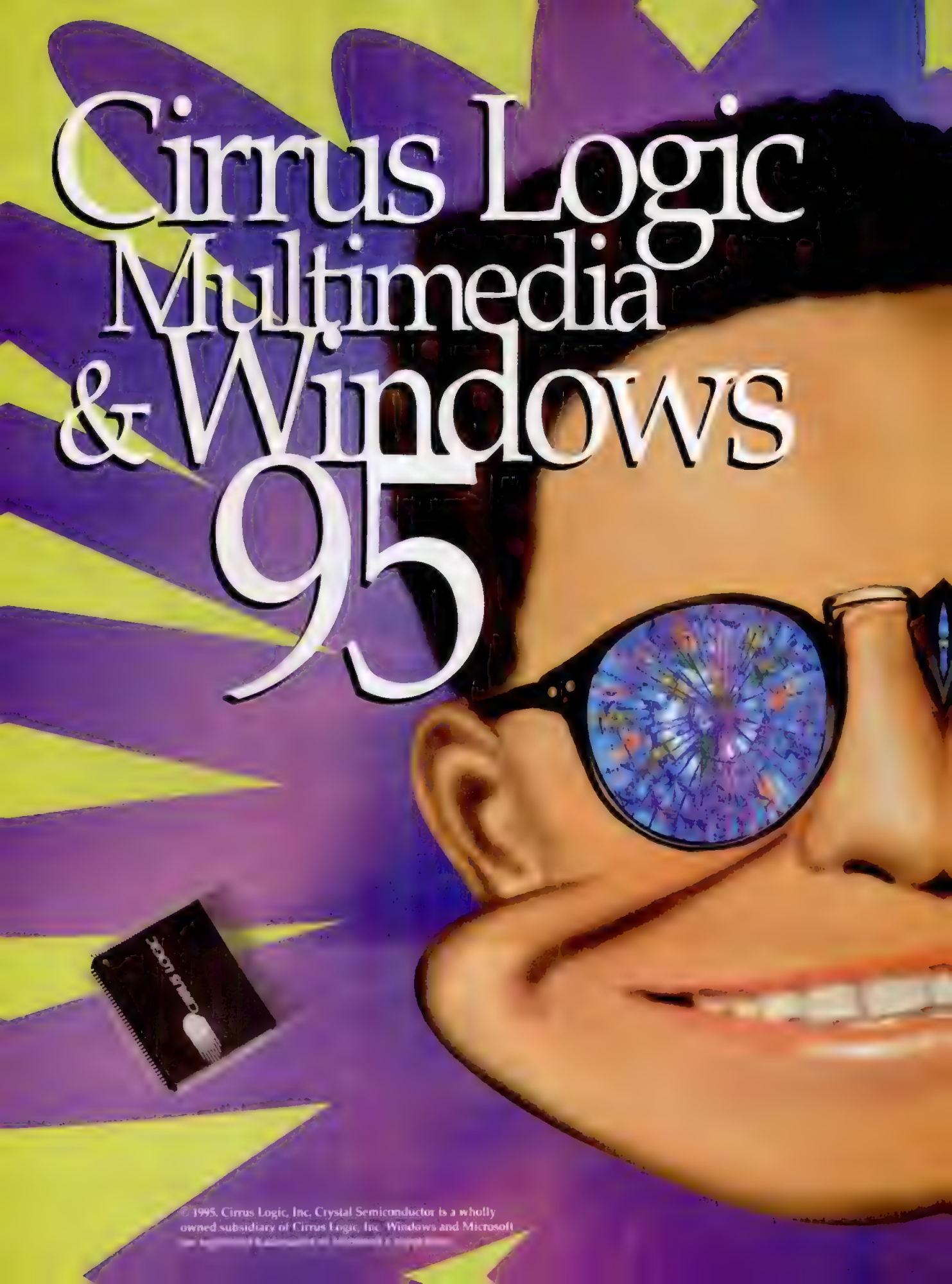
Cirrus Logic Multimedia & Windows 95



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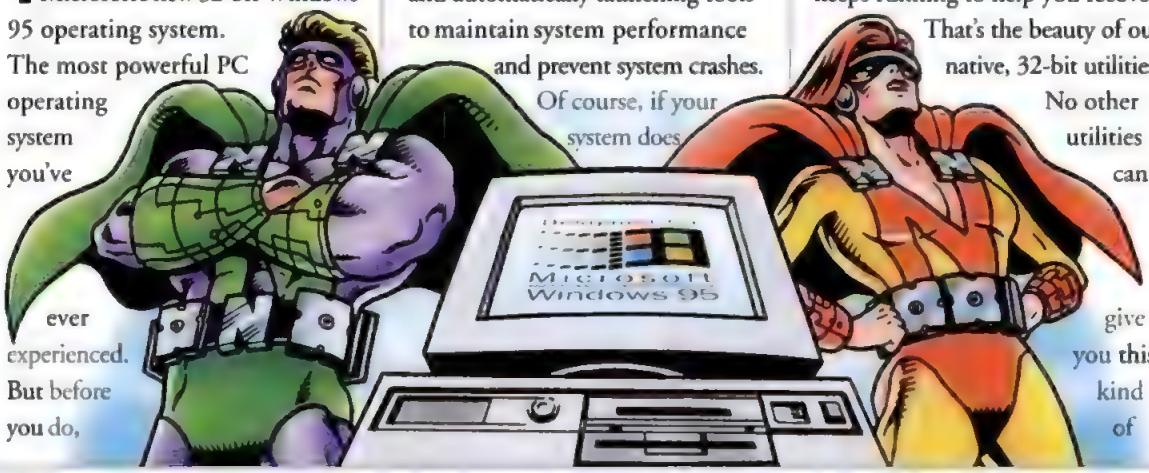
Graphics Accelerator Cards

Continues

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	MGA [illegible] MGA 64 [illegible]	MGA64 DRV Ver 1.0	Yes No	No	MGA64 DRV, Ver 1.0	Yes Yes (BBS, CIS)	MGA64 DLL, Ver 1.01	MGA64 DLL Ver 1.00
	MGA [illegible] Plus MGA 64 [illegible]	MGA64 DRV [illegible]	Yes No	No	MGA DRV, Ver 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver 2.10	MGA [illegible] Ver 2.00
	MGA [illegible] Plus 200 MGA 64 [illegible]	MGA64 DRV Ver 2.11	Yes No	No	MGA DRV, Ver 1.0	Yes Yes (BBS, CIS)	MGA DLL, Ver. 2.10	MGA32 DLL Ver. 2.00
Media Vision [illegible] TechSupp@MediaVis.com; Web site, http://www.media- [illegible]	[illegible] 1024 Media [illegible]	PG1024 DRV Ver 1.6	Yes No	No	None	No No	None	None
	[illegible] 1280 Media [illegible]	PG1280 DRV Ver 1.1	Yes No	No	None	No No	None	None
	[illegible] (this product does not require an accelerator chip)	Promotv.drv Ver 2.1	Yes No	Yes	N/A	No No	None	None
Micro-Labs Inc. [illegible]	Ultimate TrueColor XL2 Tseng ET4000/W32	Windows 3.1, 2.17.95	Yes No	No	None	Yes No	Windows NT 3.5 2.6.95	Supported by OS
	Ultimate TrueColor XL2 Vx Tseng ET4000/W32	Windows 3.1, 2.17.95	Yes No	No	None	Yes No	Windows NT 3.5 [illegible]	Supported by OS
	Ultimate TrueColor XLp, PCI, Tseng ET4000/W32p	Windows 3.1, 2.17.95	Yes No	No	None	Yes No	Windows NT 3.5 2/6/95	Supported by OS
	Ultimate TrueColor XLpVx Tseng ET4000/W32p	Windows 3.1, 2.17.95	Yes No	No	None	Yes No	Windows NT 3.5 2/6/95	Supported by OS
	Ultimate VGA Tseng ET4000	Windows 3.1, 12.8.94	Yes No	No	None	Yes No	Supported by OS	Supported by OS
	Ultimate VGA TrueColor Tseng [illegible]	Windows 3.1, 12.8.94	Yes No	No	None	Yes No	Supported by OS	Supported by OS
Mirage Multimedia Computers [illegible] internet, mirage@lainet.com, Web site, http://www.lainet.com/mi- [illegible]	Storm 1600 Tseng ET 4000	MIR-W311 DRV Ver 3.11	Yes No	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1600 S3 864	MIR-W311 DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM Ver. 3.0
	Storm 1600 PRO-4M-PCI-48 KHZ Fixed Freq, S3 968	MIR-W311 DRV, Ver. 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver. 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1600 PRO-4M-PCI-64 KHZ Fixed Freq, S3 968	MIR-W311 DRV Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1600 PRO-4M-PCI-75 KHZ Fixed Freq, S3 968	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM, Ver 3.0
	Storm 1600 PRO-4M-PCI-Multi Scan, S3 968	MIR-W311.DRV, Ver. 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35.DRV, Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1280 Tseng ET 4000	MIR-W311 DRV Ver 3.11	Yes No	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1280-16 S3 924	MIR-W311 DRV, Ver 3.11	Yes No	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1280-256, S3 801/805	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35.DRV, Ver 3.5	MIR-OS30 OEM Ver 3.0
	Storm 1280-256V, S3 924	MIR-W311.DRV, Ver 3.11	Yes No	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM Ver 3.0
	Wind 1280-33 KHZ Fixed Freq, Tseng ET 4000/W32p	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM Ver 3.0
	Wind 1280-[illegible] KHZ Fixed Freq, Tseng ET 4000/W32p	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35.DRV, Ver. 3.5	MIR-OS30 OEM Ver 3.0
	Wind 1280-64 KHZ Fixed Freq, Tseng ET 4000/W32p	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35.DRV, Ver 3.5	MIR-OS30 OEM, Ver 3.0
	Wind 1280-75 KHZ Fixed Freq, Tseng ET 4000/W32p	MIR-W311 DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM, Ver 3.0
	Wind 1280-Multi Scan, Tseng ET 4000/W32p	MIR-W311.DRV, Ver 3.11	Yes Yes	Yes	N/A	No Yes (BBS)	MIR-NT35 DRV, Ver 3.5	MIR-OS30 OEM, Ver 3.0
miro Computer Products Inc Phone, 415-855-0940, fax, 415-855-9004, [illegible] CompuServe, GO MIRO; Internet, support@miro.mirousa.com	[illegible] Avance Logic ALG2301 (PCI) and Avance Logic ALG2228 (VL)	[illegible] for Windows, Ver 1.20	[illegible]	N[illegible]	[illegible]	[illegible]	[illegible] for Windows NT, Ver 1.10	[illegible] for OS [illegible]
	[illegible] S3 86C805	[illegible] for Windows, Ver 1.41	[illegible]	N[illegible]	[illegible]	[illegible]	[illegible] for Windows NT Ver 1.[illegible]	[illegible]
	[illegible] S3 [illegible]	[illegible] for Windows Ver 2.0	Yes Yes	N[illegible]	[illegible]	Yes Yes (BBS, CIS)	[illegible] for Windows NT Ver [illegible]	[illegible]

N/A—Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means that driver support is built into the operating system.

You're ready to make the move to Microsoft's new 32-bit Windows 95 operating system. The most powerful PC operating system you've ever experienced. But before you do, upgrade your utilities to Norton Utilities® for Windows 95.



NORTON UTILITIES PROVIDES THE ONLY AUTOMATIC DATA RECOVERY AND CONTINUOUS SYSTEM PROTECTION FOR WINDOWS 95.

IT'S A 32-BIT WORLD OUT THERE.

You already know Norton Utilities is the best set of tools for system protection, hard disk optimization and data recovery.

What you may not realize is that your current 16-bit utilities won't run under Windows 95.

And the simple utilities found in Windows 95 itself don't offer sufficient data protection for life in a 32-bit world.

Which is why you need the new Norton Utilities for Windows 95.

The first thing Norton Utilities for Windows 95 will do for you is tune up your system for Windows 95 by optimizing your hard drive and cleaning out all of the files you no longer need.

Then Norton Utilities runs in the background, monitoring your system and automatically launching tools to maintain system performance and prevent system crashes. Of course, if your system does crash or you accidentally erase a file, Norton Utilities for Windows 95 gives you the data recovery tools users have relied on from day one.

Even if other applications crash, Norton Utilities for Windows 95 keeps running to help you recover. That's the beauty of our native, 32-bit utilities. No other utilities can give you this kind of continuous, real-time protection and data recovery in the brave new world of Windows 95.

NORTON UTILITIES FOR WINDOWS 95

PRE-INSTALLATION TUNE-UP
Frees up disk space and provides a comprehensive pre-installation physical.

NORTON SYSTEM DOCTOR
Continuously monitors all vital resources and data integrity. Alerts you to impending disaster and recommends action or fixes problems automatically.

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Automatically diagnoses and repairs file system problems using the speed and safety of 32-bit technology.

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Diagnoses potential conflicts and configuration problems with detailed system information and performance testing.

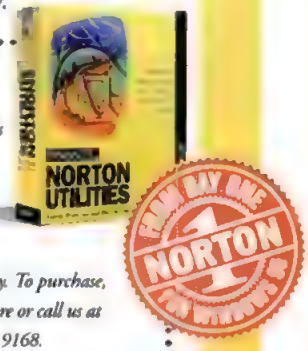
NORTON SPEED DISK™
Automatically optimizes drive and reduces future fragmentation using 32-bit technology.

PROTECT YOUR DATA FROM DAY ONE.

And like every software product from Symantec, Norton Utilities for Windows 95 comes with a full sixty-day money-back guarantee.

So you've got nothing to lose. Except your data. Get your trade-up edition of Norton Utilities for Windows 95 today.

If you own Norton Utilities, Norton Desktop for Windows or PC Tools, get your $59.95 trade-up edition of Norton Utilities for Windows 95 today. To purchase, visit your software store or call us at 1-800-450-9760, ext. 9168.*



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Graphics Accelerator Cards

Continues

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	miroCrystal 20SV S3 vision964	HighSpeed drivers for Windows Ver. 2.0	Yes Yes	No	7/95	Yes Yes (BBS, CIS)	HighSpeed drivers for Windows NT Ver. 1.10	HighSpeed drivers for OS/2
	miroCrystal 40SV S3 vision964	HighSpeed drivers for Windows, Ver. 2.0	Yes Yes	No	7/95	Yes Yes (BBS, CIS)	HighSpeed drivers for Windows NT Ver. 1.10	HighSpeed drivers for OS/2
	miroVideo 12PD, Alliance ProMotion 3210	HighSpeed drivers for Windows, Ver. 2.0	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS)	HighSpeed drivers for Windows NT, Ver. 1.10	HighSpeed drivers for OS/2
	miroVideo 20PV avi, Weitek Power 9100	HighSpeed drivers for Windows, Ver. 2.02	Yes Yes	No	7/95	Yes Yes (BBS, CIS)	HighSpeed drivers for Windows NT Ver. 1.10	HighSpeed drivers for OS/2
	miroVideo 20TD live, Tseng ET4000/W32p	HighSpeed drivers for Windows, Ver. 1.21	Yes Yes	No	7/95	Yes Yes (BBS, CIS)	HighSpeed drivers for Windows NT Ver. 1.10	HighSpeed drivers for OS/2
Nth Graphics Phone, 800-624-7552; fax, 512-832-5954; BBS, 512-832-1962; CompuServe, 73417,1221	Nth 150, C&T 480	nt1024nt.drv, nt1280nt.drv, Ver. 1.51	No Yes	No	None	No No	Supported by OS	None
	Nth Apex, S3 864	apexpci.drv, Ver. 1.3	No Yes	No	None	No No	Supported by OS	Via third party
	Nth Apex 4MB, S3 964	apexpci.drv, Ver. 1.2	No Yes	No	None	No No	Supported by OS	Via third party
	Nth Double Edge, IBM XGA II	mxga10.drv, Ver. 1.08	Yes Yes	No	None	Yes No	None	mxga driver
	Nth Edge 1280, C&T 481	w4381.drv, Ver. 1.31	No Yes	No	None	No No	Supported by OS	None
	Nth S3 Advantage S3 801/805	nth3k.drv, Ver. 1.2	No Yes	No	None	No No	Supported by OS	Via third party
Number Nine Visual Technology Corp. Phone, 617-674-0009; fax, 617-674-2919; BBS, 617-862-7502; CompuServe, GO NINE; Internet, *ftp.nine.com*; Web site, *http://www.nine.com*	#9GXE, S3 928	#9GXE.DRV, Ver. 4.15	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	#9GXE, S3 928	#9GXE.DRV, Ver. 4.15	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	#9GXE64, S3 864	#9GXE64.DRV, Ver. 2.38	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.1	Supported by OS
	#9GXE64 Pro, S3 964	#9GXE64.DRV, Ver. 2.38	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.1	S3.DRV, Ver. 2.52
	#9GXE64 Pro 1600, S3 964	#9GXE64.DRV, Ver. 2.38	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.1	S3.DRV, Ver. 2.52
	#9 Imagine128, #9 Imagine128 Processor	I128.DRV, Ver. 2.27	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	I128.DRV, Ver. 1.13	IMAGINE.DRV, Ver. 1.12
	#9 Imagine128 1600, #9 Imagine128 Processor	I128.DRV, Ver. 2.27	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	I128.DRV, Ver. 1.13	IMAGINE.DRV, Ver. 1.12
	#9 Imagine128 Pro, #9 Imagine128 Processor	I128.DRV, Ver. 2.27	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	I128.DRV, Ver. 1.13	IMAGINE.DRV, Ver. 1.08
	9FX Vision330, S3 Trio 64	9Vision.DRV, Ver. 1.16	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.11	S3.DRV, Ver. 2.52
	9FX Motion531, S3 Vision 868	9Motion.DRV, Ver. 1.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.11	S3.DRV, Ver. 2.52
	9FX Motion771, S3 Vision 968	9Motion.DRV, Ver. 1.15	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.DRV, Ver. 1.11	S3.DRV, Ver. 2.52
Orchid Technology Phone, 510-683-0300; fax, 510-490-9312; BBS, 510-683-0327; CompuServe, GO ORCHID; Internet, *tech_support@orchid.com*; Web site, *http://www.netscape.orchid.com*	Celsius VLB, IIT AGX015	Not named	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	None
	Fahrenheit 64, S3 Vision 864	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Ver. 2.3	Ver. 2.51
	Fahrenheit 1280 Plus, S3 Vision 864	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Fahrenheit 1280 Plus/VLB, S3 Vision 864	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Fahrenheit Pro64, S3 Vision 964	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Ver. 1.11	Ver. 2.51
	Fahrenheit ProVideo 64, S3 Vision 968	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Ver. 1.11	Ver. 2.51
	Fahrenheit VA/Fahrenheit VA/VLB, S3 Vision 864	Not named	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Kelvin 64, Cirrus Logic Logic 5434	KIR.DRV, Ver. 1.4	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Kelvin EZ, Cirrus Logic Logic 5430	KIR.DRV, Ver. 1.4	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Kelvin MPEG, Cirrus Logic 5434	KIR.DRV, Ver. 1.4	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	Kelvin Video 64, Alliance 6410	PROMTN32.DRV, Ver. 1.1	Yes Yes	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

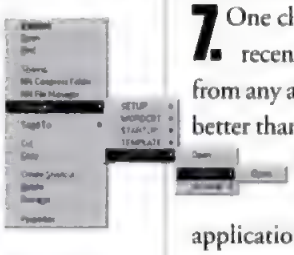
Congratulations! You're the proud owner of Microsoft's Windows 95 operating system. Working on a PC has never been easier.

Now try these ten easy exercises and see how you can work even better and faster in Windows 95 with the all-new Norton Navigator.™

~~CLICK.~~ ~~CLICK.~~ ~~CLICK.~~ CLICK.

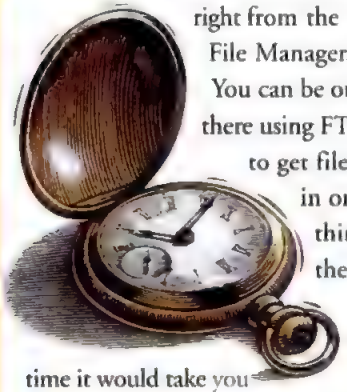
1. First, copy a file from one directory to another. Okay, now copy another file. On average, it takes about eleven steps per file. Now copy a file with Norton Navigator. Mission accomplished. One step.

2. Opening a folder in Windows 95 takes a full five clicks of your trusty mouse. But with Norton Navigator, you can open any folder with just one simple click.



3. Compress a file. Our built-in PK-Zip compatible compression saves you a minute every time.

4. Use Norton Navigator to plug into your Internet connection right from the File Manager. You can be out there using FTP to get files in one third the time it would take you with a separate application.



5. Try a word search for "profits" or any other text string within files. It's at least ten times faster on average with Norton Navigator. No matter how many files you have. Or how big they are. In fact, the bigger the files, the more time you'll save.

6. Save another minute every time you delete, move, zip, or encrypt from any application's Open or Save dialog box. (Are you keeping count?)

7. One click is all it takes to access recently opened files or folders from any application. Now isn't that better than wading through folders?

8. Launch your favorite files, folders, or applications simply by pushing a button on the Norton Taskbar. No more going up and down to and from the Start menu over and over again.

9. With Norton Navigator, you can create a different desktop for each project. So you can find your work more easily. And save even more time.

10. Windows 95 supports long file names for all of your new 32-bit applications. Norton Navigator supports long file names for most 16-bit applications, too. So you'll never again have to remember what "billgbox" means.

THE TOP 10 REASONS WHY NORTON NAVIGATOR USERS WORK FASTER IN WINDOWS 95.

MAKE WINDOWS 95 AN EVEN BETTER PLACE TO BE.

Well, there you have it. Our Top Ten. But try Norton Navigator for yourself and we're sure you'll find your own favorites. Because one of the greatest things about Norton Navigator is it lets you work the way you want to work. Needless to say, it comes with our standard 60-day money-back guarantee. So get your trade-up edition today.

NORTON NAVIGATOR FOR WINDOWS 95

NORTON NAVIGATOR ACCELERATES YOUR FILE MANAGEMENT IN WINDOWS 95.

Norton Navigator puts file management at your fingertips with Norton File Manager, Explorer Extension and FileAssist.

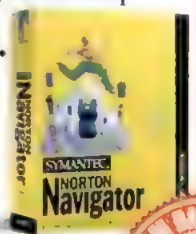
Norton Folder Navigator lets you open, copy, move or create a shortcut for any folder with just one mouse click.

Norton Taskbar features multiple desktops that let you organize your files and find your work faster.

Norton FastFind performs specific text string searches at least ten times faster than Windows 95.

SYMANTEC.

If you own Norton Desktop, PC Tools, XTree, or Norton Commander, get your $39.95 trade-up edition of Norton Navigator for Windows 95 today. To purchase, visit your software store or call us at 1-800-450-9760 ext. 9171.*



CIRCLE 173 ON READER SERVICE CARD

*Trade up edition will run only when specified Symantec and Central Point products are already installed. Check with your software store for qualifying versions. Price does not include shipping, handling or any applicable sales tax. Symantec is a registered trademark and Norton Navigator is a trademark of Symantec Corporation. All other brand names or trademarks are the property of their respective owners. © 1995 Symantec Corporation. All rights reserved. Visit us on the Internet at http://www.symantec.com. In Canada call 1-800-441-8404. In Australia call 2-9-20-6577. In Europe call 31-71-354111.

Graphics Accelerator Cards

Continues

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	[illegible] Power [illegible]	Not named	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	None
	[illegible] MC Tseng ET4000	Not named	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	[illegible] Tseng ET4000	Not named	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
Power Pixel Technologies [illegible]	[illegible] Tseng ET4000 W32p	Power Pixel Ver. 2.0	Yes No	No	4th quarter 1995	Yes Yes (BBS)	Power Pixel NT 1	Power Pixel Warp 1
PraeoTek Inc. (formerly VidTech) [illegible] fax 612-780-2040, BBS 612-780-8033	[illegible] Tx [illegible] Oak Spitfire 64107	Not yet released	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax SA, Cirrus Logic 5426/29	Ver. 1.41	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax L20, S3 864	Ver. 1.37	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax LB, Cirrus Logic 5426/29	Ver. 1.41	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax 10, Cirrus Logic 5430	Ver. 1.01	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax P12 TV, Oak Spitfire 64107	Not yet released	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	FastMax P20, S3 864	Ver. 1.37	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
	GraphMax P24, S3 964	Ver. 1.37	Yes No	No	10/95	No Yes (BBS)	None	OS/2 driver
SPiDER Graphics Inc. Phone 408-526-9836 fax 408-526-1622, BBS 408-526-1219	Black Widow, IIT AGX-015	AGX.DRV, Ver. 1.10	Yes No	No	Win 95 ship date	No Yes (BBS)	None	None
	Black Widow Plus, IIT AGX-016	AGX.DRV, Ver. 1.10	Yes No	No	Win 95 ship date	No Yes (BBS)	None	OS/2 Ver. 1.10
	SPiDER 32VLB, Cirrus Logic 5426	256_1280.DRV, Ver. 1.43	Yes No	No	Win 95 ship date	No Yes (BBS)	CL542XX.SYS Ver. 1.22	OS/2 Ver. 1.22
	SPiDER 32VLB Plus, Cirrus Logic 5428	256_1280.DRV, Ver. 1.43	Yes No	No	Win 95 ship date	No Yes (BBS)	CL542XX.SYS Ver. 1.22	OS/2 Ver. 1.22
	SPiDER 64, Cirrus Logic 5434	5434H.DRV, Ver. 1.20	Yes No	No	Win 95 ship date	No Yes (BBS)	CL542xx.SYS Ver. 1.22	OS/2 ver. 1.22
	SPiDER 256 Cache, C&T F64300	WGADGX8.DRV, Ver. 1.20	Yes No	No	Win 95 ship date	No Yes (BBS)	CHIP.SYS Ver. 1.10	OS/2 Ver. 1.10
	Tarantula 64, S3 Vision 964	S3VSND.DRV, Ver. 1.20	Yes No	No	Win 95 ship date	No Yes (BBS)	S3.SYS Ver. 1.0x	OS/2 2.0
	Tarantula 64 MK II, S3 Vision 968	S3VIS68.DRV, Ver. 1.45	Yes No	No	Win 95 ship date	No Yes (BBS)	S3.SYS Ver. 1.0x	OS/2 2.0
	Tarantula Lite, S3 Trio 732	S3TRIO.DRV, Ver. 1.20	Yes No	No	Win 95 ship date	No Yes (BBS)	S3.SYS Ver. 1.0x	OS/2 Ver. 2.0
STB Systems Inc. Phone 214-234-8750 fax 214-234-1306, BBS 214-437-9615; CompuServe GO STB Internet [illegible] Web site http://www.stb.com	Horizon, Cirrus Logic 5426, Cirrus Logic 5428, and Cirrus Logic 5429	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	Horizon+, Cirrus Logic 5434	STBVISN.DRV 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	Horizon 64, Sierra Falcon/64	STBVISN.DRV 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	CL54xx.SYS 11/3/94	CL54xx.DSP 12/12/94
	LightSpeed, Tseng ET4000/W32p	TLW32P.DRV, 12/28/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	W32.SYS, 12/30/93	W32.DSP 11/15/94
	Pegasus, S3 928	PEG_FLAT.DRV, 9/28/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	PowerGraph C33, WD C33	WD33nn_n.DRV, 9/12/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	PowerGraph 32, S3 Trio 32	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	PowerGraph 64, S3 Trio 64	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.SYS, 1/21/95	S3VIDEO.DSP 7/1/94
	PowerGraph PRO, S3 Vision864	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	None	None
	Sprint 32, Trident 9440	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	TRIDENT.SYS, 11/7/94	TR9440.DSP, 11/29/94
	Velocity 64V, S3 Vision968	STBVISN.DRV, 1/3/95	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	S3.SYS, 2/27/95	S3VIDEO.DSP, 7/1/94
TechWorks Phone 512-794-8533, fax 512-794-8520 BBS 512-794-9219 America Online TechWorks	Thunderbolt ISA (Thunderbolt 64 series), Sierra chip	Ver. 1.43	No Yes	No	None	No No	None	None
	Thunderbolt PC (Thunderbolt 64 series), Sierra chip	Ver. 2.0	No Yes	No	None	No No	None	None
	Thunderbolt PCI (Volante series), Trident D9420	Ver. 6.1.1	No Yes	No	None	No No	None	None

N/A = Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means that driver support is built into the operating system.

Windows 95 is here. And it's really terrific.

Except for one thing: it doesn't include any anti-virus protection. And your old anti-virus software won't work in Windows 95 either. But thousands of old viruses will.

So that leaves you with a choice. Do nothing and hope you never come across an infected floppy or download an infected file. Or buy a new anti-virus software product that can work in this new environment.

But which anti-virus product should you buy? Norton AntiVirus® for Windows 95.

DETECTION, PREVENTION, DESTRUCTION. IF YOUR ANTI-VIRUS SOFTWARE DOESN'T HAVE ALL THREE, YOU'LL BE COMPLETELY EXPOSED TO VIRUSES IN WINDOWS 95.

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Norton AntiVirus for Windows 95 is NCSA certified to detect 100% of the viruses found in circulation. And recent independent tests* conclusively demonstrate that Norton AntiVirus for Windows 95 detects and destroys as many or more known viruses as any other anti-virus product around.

But our virus protection doesn't stop there.

Norton AntiVirus for Windows 95 also protects you from new, unknown viruses. Thanks to a unique virus detection technology that allows us to spot any suspicious activity, no matter where it's lurking.

So your system is safe. Not just from the viruses everybody already knows about. But also from the new viruses created every day.

What's more, you get all this ironclad protection without a host of long annoying disruptions to your work.

Because Norton AntiVirus for Windows 95 scans files fast. Even compressed files.

Designed for Microsoft® Windows®95

And Norton AntiVirus works in the background, continuously monitoring file access and usage. So it can stop viruses in their tracks. Which means you don't have to worry every time you put a floppy in your disk drive.

NORTON ANTIVIRUS FOR WINDOWS 95

WINDOWS 95 COMPLIANT
Full 32-bit application. Supports long file names and Universal Naming Conventions.

AUTOMATIC BACKGROUND MONITORING
Virtual device driver unobtrusively checks for viruses in the background. Ensures backups and files transferred are virus-free.

FAST SCANNING
Provides ironclad virus protection without affecting productivity. Scans even compressed files fast.

EXCLUSIVE VIRUS SENSOR
Provides continuous, transparent protection against new, unknown viruses.

NCSA CERTIFIED
Detects 100% of viruses found in circulation

THE NO RISK ANTI-VIRUS SOLUTION.

Needless to say, Norton AntiVirus for Windows 95 comes with our standard sixty-day money-back guarantee.

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TRADE-UP EDITION NOW ON SALE.

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Windows 95 promises faster, more powerful personal computing. But to unleash that power you'll need a ton of storage capacity. Fortunately, Conner offers a wide range of cost-effective storage solutions designed specifically for your Windows 95 needs. Including a broad range of high performance, easy-to-use disk drives, in capacities of 540 to 1275 MB, backed by a 3 year warranty.

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Start

Find Anyone, Anywhere even faster, with the new PhoneDisc® for Windows® 95

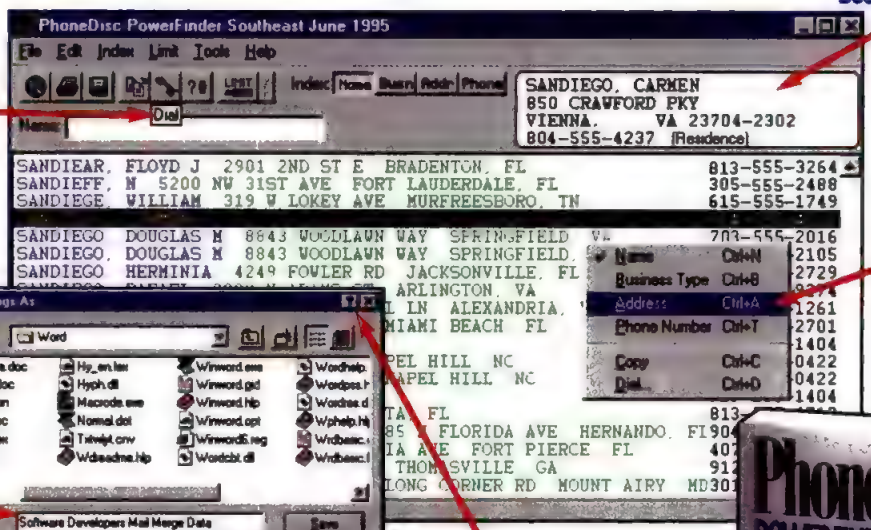
100 MILLION PHONE LISTINGS ON CD-ROM!

Integrates with Windows® Telephony!

PhoneDisc® is designed to link to, and dial, using your favorite Windows® 95 contact manager or integrated phone.

Say goodbye to "cut & paste."

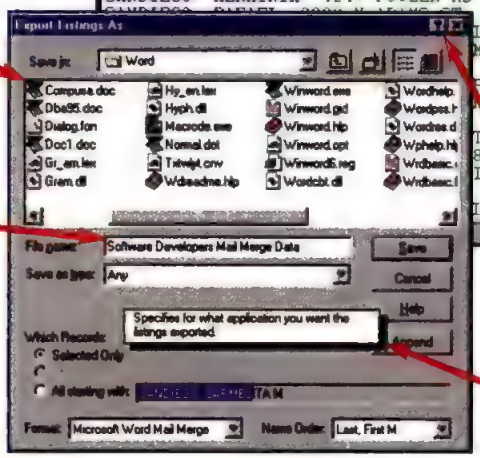
Because PhoneDisc® is designed for Windows® 95, you can Drag a listing and Drop it into another application, in one quick easy motion.



Shortcuts!

Right click on most items, and get a specific menu on what you can do with that item!

Explorer Style file dialogs!



Long File Names!

Since PhoneDisc® is designed for Windows 95, you can name your files whatever you want!

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Top 100 CD-ROMS, PC Magazine, June 1995 · Best Buy, Home Office Computing, December 1994 · "RECOMMENDED", Computer Reseller News, May 1995 · 50 Best CD-ROMs, MacUser, October 1994 · "A-LIST", PC Computing, June/July 1995 · Best Business Product, CD-ROM Home & Office World Expo, August 1994 · CD-ROM Home & Office World 1994

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Graphics Accelerator Cards

Ends

Company	Product name, accelerator chip	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/ Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	Thunderbolt VL (Thunderbolt 64 series), Sierra chip	Ver. 2.0	No Yes	No	None	No No	None	None
	Thunderbolt VL (Volante series), Tseng ET4000/W32p	Ver. 3.1.2	No Yes	No	None	No No	None	None
UMAX Phone, 800-562-0311; fax, 510-651-8834; BBS, 510-651-2610	Maxmedia CX/Expert, S3 Vision 864	Ver. 1.2	No Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.2	Ver. 1.2
	Maxmedia CX/Pro, S3 Vision 864 (three chips)	Ver. 1.4	No Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.4	None
	Maxmedia CX/Trio, S3 Trio	Ver. 1.11	No Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.11	Ver. 1.11
VideoLogic Phone, 800-578-5644; fax, 415-875-4167; BBS, 415 875-7748; CompuServe, GO VIDEOLOGIC	928Movie, S3 928	Ver. 1.1.1	Yes No	No	Win 95 ship date	Yes Yes (BBS)	None	None
	GrafixStar 300, S3 Trio 64	Ver. 1.1	Yes No	No	Win 95 ship date	No Yes (BBS)	Ver. 1.0	Ver. 1.0
	GrafixStar 500, S3 Vision 868	Ver. 1.1	Yes No	No	Win 95 ship date	No Yes (BBS)	Ver. 1.0	Ver. 1.0
	GrafixStar 700, S3 Vision 968	Ver. 1.1	Yes No	No	Win 95 ship date	No Yes (BBS)	Ver. 1.0	Ver. 1.0
	PCIMovie, Weitek Power 9100	Ver. 1.1.2	Yes No	No	None	No No	None	None
Western Digital Corp. Phone, 714-932-5000; fax, 714-932-6498; BBS, 714-753-1234; America Online, Western Digital	Paradise Accelerator 24, RocketCHIP WD33	33, Ver. 1.31	No Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	Paradise Bahamas 64, S3 86C764	T64, Ver. 1.0	No Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	Paradise Bali 32, ARK 1000PV	000, Ver. 1.0	No Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	Paradise Barbados 64, S3 86C964	964, Ver. 1.0	No Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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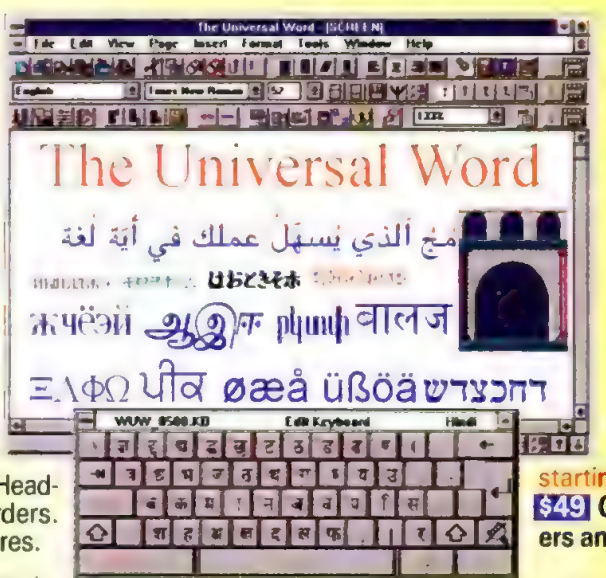

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CIRCLE 041 ON READER SERVICE CARD

Start

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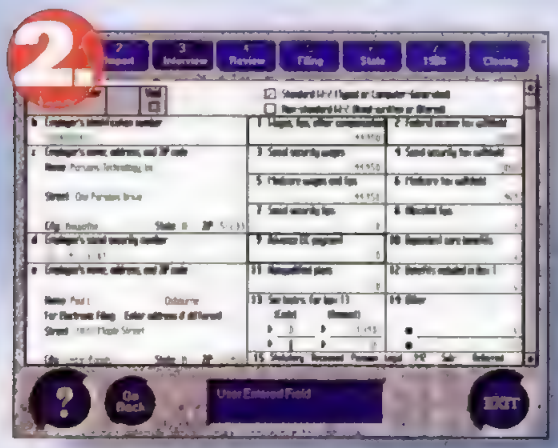
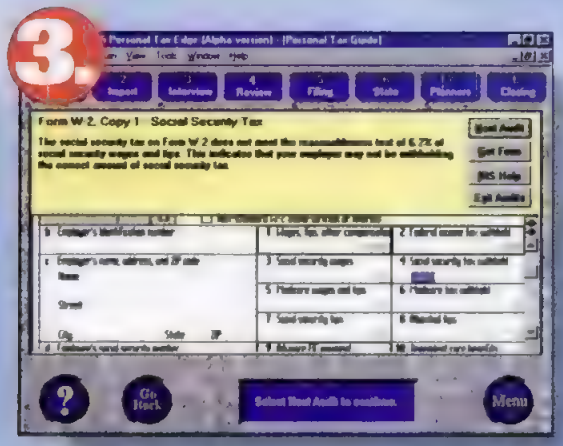


It organizes and calculates. Personal Tax Edge automatically performs all necessary tax calculations, enters the information on all related forms and then audits your return like a sharp-eyed accountant.



Just print, sign and mail! Once the calculations are done, print your completed IRS-approved forms on your dot matrix or laser printer.

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Version: ❑ Windows 95 ❑ Windows 3.1 ❑ Macintosh** ❑ DOS

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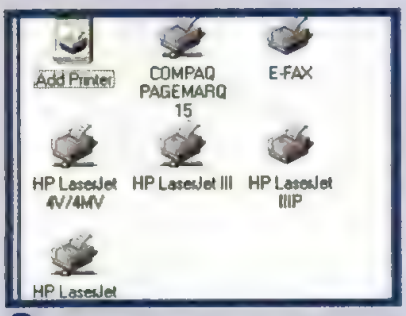
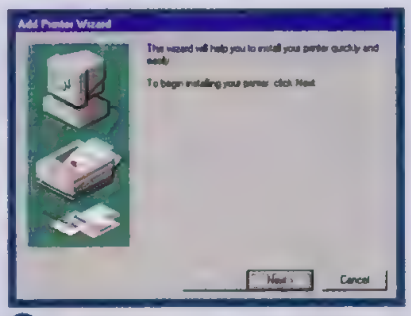
CIRCLE 104 ON READER SERVICE CARD

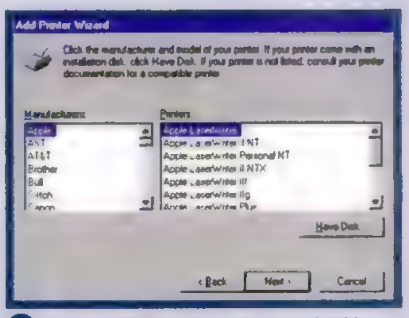
Printers



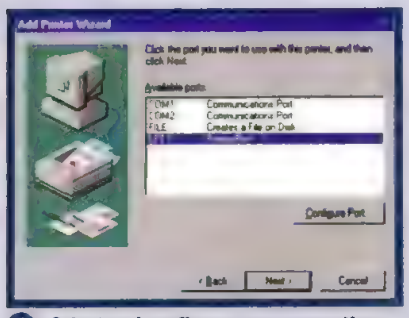
1 Windows 95 now includes an Add Printer wizard. You can access it by clicking on the printer icon in the Windows 95 Control Panel.



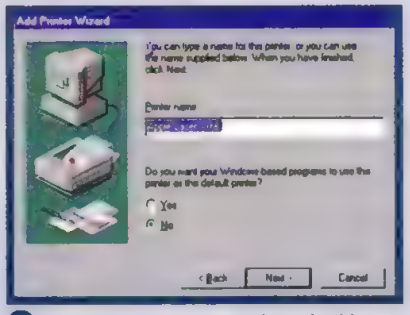
2 This dialog box is simply an introduction to the wizard process.



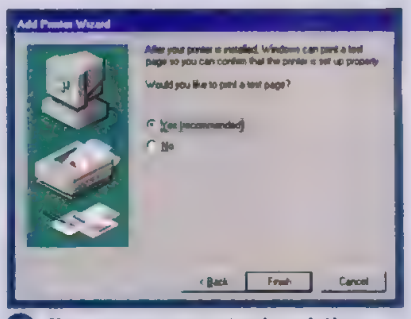
3 Printer listings are now organized by manufacturer; vendors are listed on the left, while their associated printers are listed on the right. If you can't find your printer, click the Have Disk button to add it to the list.



4 Select and configure your connections in this dialog box.



5 You can rename your printer in this dialog box. This can be especially useful in a networked environment.



6 You can test your setup by printing a test page and, if everything works, accept the configuration.

The printing experience under Windows 95 should provide instant gratification for anyone who has printed under Windows 3.*x*. Many problems have been thoroughly addressed, and the whole printing architecture has been revamped. With a new 32-bit print subsystem, new enhanced metafile (EMF) spooling, and built-in, preemptive multitasking, Windows 95 improves greatly upon every aspect of printing, from installing the printer to viewing your printed page. It should be noted that while printer drivers remain 16-bit, they still need to be updated in order to take advantage of the new print subsystem.

Out of the box, Windows 95 supports more than 800 different printers. A simple printer "minidriver" architecture makes this possible. A printer manufacturer needs only write to this "generic" driver (usually providing a table of device-specific commands and information) to add support for it under Windows 95. Microsoft has taken pains to make this easy to do, and the task shouldn't require many development hours.

Windows 3.*x* had no shortage of print problems. It required hand-setting global-printer settings, like time-outs for both "device not selected" and "transmission retry," when printing problems were encountered under the defaults. This, especially when certain types of data were sent, made applications feel choppy, and the cursor responded slowly until the print job was completed. In effect, Windows 3.*x* was force-feeding the printer.

In Windows 95, the 32-bit preemptively multitasked print spooler spools output from the application to support background printing. The form of data has changed too. The new EMF spooling technique sits right at the point after which the application sends a print command to the Windows 95 print API. These GDI calls are quickly processed in native form by Windows 95 and turned into an EMF, which is processed by the print spooler. The print spooler then passes it to the printer driver and then on to the printer.

Other new printing improvements are pleasant surprises, such as Plug and Play support for newer printers—which makes the installation process a snap—and better network printing support. There is also support for the new bidirectional printers and ports, and deferred printing for mobile computing, which allows you to preprocess print jobs without being connected to a printer. This means you can batch- output them when you return to the office. Color printing is also improved, with the integration of image color-matching support (ICM) technology licensed from Kodak.—*JM*

THE DRIVER MANUAL

Printers

Company	Product name	Current driver (name, date, or version)	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
Apple Computer Inc. Phone, 800-538-9696 fax, 800-510-2834, Web site, *http://www.apple.com*	LaserWriter 16/600 PS	Adobe PS, Ver. 2.1.2 (emulation)	No	Adobe PS 4.0	No Yes (AOL, CIS, Web)	No	None	None
	LaserWriter Select 360	Adobe PS, Ver. 3.0.1 (emulation)	No	Adobe PS 4.0	No Yes (AOL, CIS, Web)	No	None	None
Brother International Corp. Phone, 800-276-7746, BBS, 714-859-2610	HJ-100i	Ver. 1.00	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HJ-400	Ver. 1.30	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-6	Ver. 1.50	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-6V	Ver. 1.50	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-10H	Ver. 1.50	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-10PS	Ver. 1.00	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-10V	Ver. 1.50	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-630	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-630M	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	None
	HL-641	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-645	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-645M	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	None
	HL-650	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	None
	HL-655M	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-660	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HL-660PS	Ver. 1.00	Yes	N/A	No Yes (BBS)	No	None	None
	HL-665	Ver. 2.40	Yes	N/A	No Yes (BBS)	No	None	None
	HL-960	Ver. 1.41	Yes	N/A	No Yes (BBS)	No	None	None
	HL-1260	Ver. 1.41	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HS-1PS	Ver. 1.1	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	HS-1PS2	Ver. 2.2	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1309	Ver. 1.6	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1324	Ver. 1.9	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1809	Ver. 1.6	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1824L	Ver. 1.9	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1909	Ver. 1.6	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-1924L	Ver. 1.9	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
	M-4309A	Ver. 1.6	Yes	N/A	No Yes (BBS)	No	None	Supported by OS
Canon Computer Systems Inc. Phone, 800-423-2366, fax, 800-922-9068, BBS, 714-438-3325, CompuServe, GO CANON	BJ-10e	Ver. 1.0	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-10ex	Ver. 1.25	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-10sx	Ver. 1.4	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-20	Ver. 1.25	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-30	Ver. 2.10	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-100	Ver. 1.0	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-130	Ver. 1.0	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-130e	Ver. 1.10	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	BJ-200	Ver. 1.2	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-200e	Ver. 1.1	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-200ex	Ver. 1.0	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-230	Ver. 1.1	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-300	Ver. 1.50	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJ-330	Ver. 1.50	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJC-70	Ver. 2.10	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJC-600	Ver. 2.0d	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJC-600e	Ver. 1.0	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJC-800	Ver. 2.01	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	BJC-4000	Ver. 2.10	Yes	N/A	Yes Yes (CIS)	Yes	Not named	Not named
	LBP-4	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-4Plus	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8II	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8IIR	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8III	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8IIIPlus	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8IIIT	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-8IIIR	Ver. 2.12	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-430	Ver. 31.3.9	Yes	N/A	Yes Yes (CIS)	Yes	None	None

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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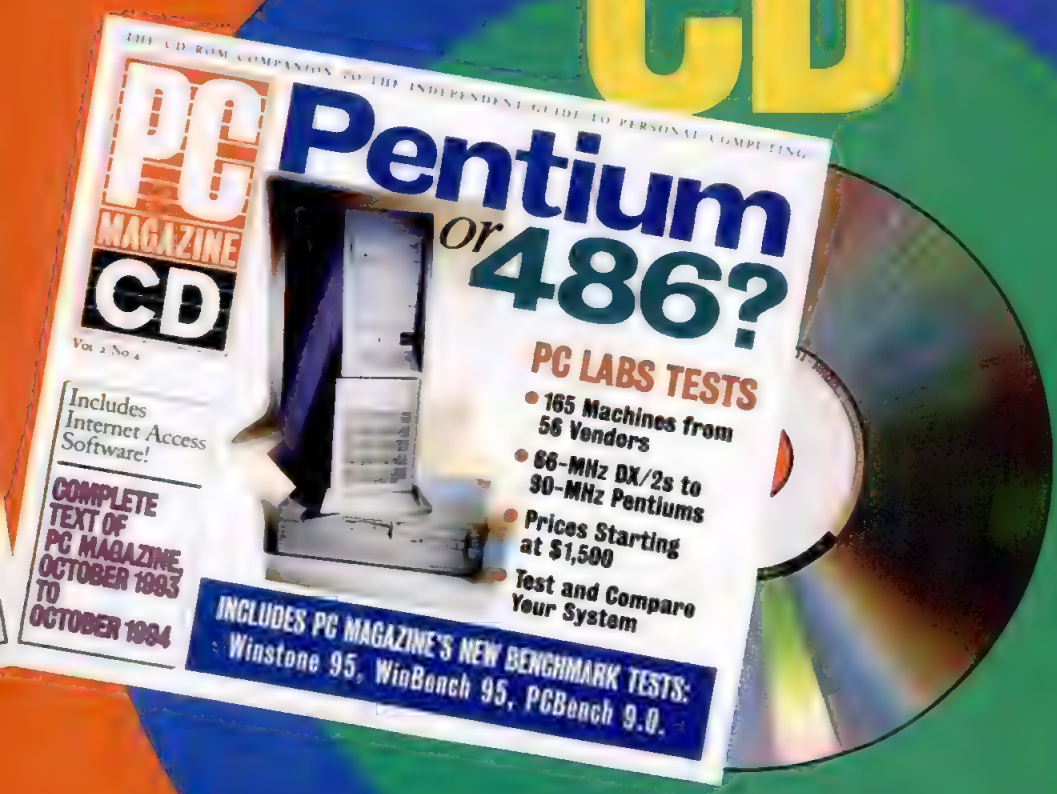

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1522 - Ferdinand Magellan/Spain

DISPROVED

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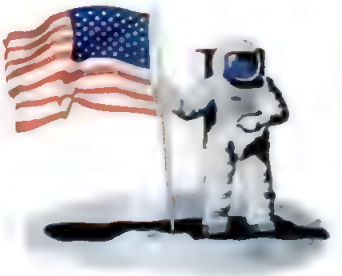
1969 - Neil Armstrong/NASA



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CIRCLE 130 ON READER SERVICE CARD

Printers

Continues

Company	Product name	Current driver (name, date, or version)	Win 95-compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	LBP-430W	Ver 1.1	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-860	Ver 2.0	Yes	N/A	Yes Yes (CIS)	Yes	None	None
	LBP-1260	Ver 2.1	Yes	N/A	Yes Yes (CIS)	Yes	None	None
Digital Equipment Corp. [illegible] 508-496-8800; Web site: [illegible] Digital.com	[illegible]	[illegible]	No	None	Yes No	No	None	None
	[illegible] 550ic	DECcolorworks, Ver 1.0	No	None	Yes No	No	None	None
	DECcolorwriter 1000	Ver 3.5	No	None	Yes No	No	None	None
	[illegible]	[illegible] 1.1, PCL5 ver 2.1	No	None	Yes No	No	None	None
	DEClaser 5100	Ver 2.1.1, PCL5E Ver 2.1	No	None	Yes No	No	None	None
	DECwriter 90ip	DECwriter 90ip, Release 1.6	No	None	Yes No	No	None	None
	DECwriter 110i	DECwriter 110i	No	None	Yes No	No	None	None
	DECwriter 500i	DECwriter 500i	No	None	Yes No	No	None	None
Fargo Electronics Inc. [illegible]	Primera	Ver. 3.1.0	Yes	N/A	No Yes (BBS AOL, CIS, Web)	Yes	None	None
	PrimeraPlus	Ver. 1.0.0	Yes	N/A	No Yes (BBS AOL, CIS, Web)	Yes	None	None
	Fotomas10	Ver 1.4.0	Yes	N/A	No Yes (BBS AOL, CIS, Web)	Yes	None	None
	Primera	Ver. 4.4	No	9/95	No Yes (BBS AOL, CIS, Web)	No	None	None
	PrimeraPro	Ver. 3.0.0	Yes	N/A	No Yes (BBS AOL, CIS, Web)	Yes	None	None
Hewlett-Packard Co. (DeskJets) [illegible]	DeskJet 310	HPADJET DRV, Ver 5.0 (emulation)	No	DESKJETC.DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 320	HPADJET DRV, Ver 5.0 (emulation)	No	DESKJETC.DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 500C	DESKJETC DRV, Ver 6.1 (emulation)	No	DESKJETC DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 520	DESKJETC DRV, Ver 6.1 (emulation)	No	DESKJETC.DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 540	DESKJETC DRV, Ver 6.1 (emulation)	No	DESKJETC DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 550C	DESKJETC DRV, Ver 6.1 (emulation)	No	DESKJETC DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 560C	DESKJETC DRV, Ver 6.1 (emulation)	No	DESKJETC DRV, Ver 6.5	Yes No	Yes (EMF only)	Supported by OS	Supported by OS
	DeskJet 660C	DESKJETC DRV, Ver 6.1 (emulation)	No	Third quarter 1995	No Yes (BBS AOL, CIS, Web)	Yes (EMF only)	Supported by OS	None
Hewlett-Packard Co. (LaserJets) [illegible] DeskJet entry for [illegible] information	HP [illegible] LaserJet	[illegible] Ver 1.01	No	hppcl5ms.drv, Ver 4.0	Yes Yes (BBS)	No	hppcl5ms.dll, Ver 3.10	laserjet.drv, Ver 30.445
	HP LaserJet 4L	hppcl5e drv, Ver 1.35	No	hppcl5ms drv, Ver 4.0	Yes No	Yes	hppcl5ms.dll, Ver 3.0	laserjet drv, Ver 30.445
	HP LaserJet 4M	hppcl5e.drv, Ver 1.35	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll, Ver. 3.0, PS 300 dpi hp4m3_v1.ppd PS 600 dpi hp4m6_v1.ppd;	laserjet.drv Ver 30.445
	HP LaserJet 4Ml	[illegible] Ver 1.35	No	[illegible] Ver 4.0	Yes Yes (MS BBS)	Yes	[illegible] Ver 3.0;	laserjet.drv Ver 30.445
	HP LaserJet 4MP	[illegible] Ver 1.35	No	hppcl5ms.drv Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll Ver 3.0 PS 300 dpi hp4mp3_v1.ppd PS 600 dpi hp4mp6_v1.ppd	laserjet.drv Ver 30.445
	HP LaserJet 4M Plus	hppcl5e drv, Ver. 1.35	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll, Ver 3.0	laserjet.drv Ver 30.445
	HP LaserJet 4MV	hppcl5e.drv, Ver 1.50	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll, Ver. 3.10	laserjet.drv Ver 30.445
	HP LaserJet 4P	hppcl5e drv, Ver. 1.35	No	hppcl5ms drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms dll, Ver 3.0	laserjet drv, Ver 30.445
	HP LaserJet 4 Plus	hppcl5e drv, Ver 1.35	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll, Ver. 3.0	laserjet.drv Ver. 30.445
	HP LaserJet 4s	hppcl5e drv, Ver 1.35	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll, Ver 3.0	laserjet.drv Ver 30.445
	HP LaserJet 4Si MX	hppcl5e drv, Ver 1.35 (emulation)	No	hppcl5ms drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms.dll Ver 3.0 PS 300 dpi hp4si3_v1.ppd PS 600 dpi hp4si6_v1.ppd	laserjet.drv Ver 30.445

N/A—Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means that driver support is built into the operating system.

Windows 95 **Your current hard drive**

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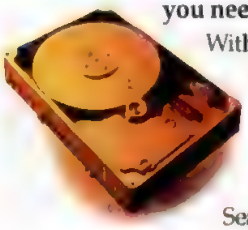

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*Source: PC Magazine, May 16, 1995
**WinBench '95, version 1.0, Disk WinMark result on representative PC platforms.
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CIRCLE 077 ON READER SERVICE CARD

Printers

Continues

Company	Product name	Current driver (name, date, or version)	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built in to Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	HP LaserJet 4V	hppcl5e.drv, Ver. 1.50	No	hppcl5ms.drv, Ver 4.0	Yes Yes (MS BBS)	Yes	hppcl5ms dll, Ver. 3.10	laserjet drv, Ver. 30.445
	HP LaserJet 5P	hppcl5e drv, Ver 1 35	No	hppcl5ms drv, Ver 4 0	Yes Yes (MS BBS)	Yes	None	laserjet drv, Ver 30 445
	HP LaserJet 5MP	hppcl5e drv, Ver 1 35	No	hppcl5ms drv, Ver 4.0	Yes Yes (MS BBS)	Yes	None	laserjet drv, Ver 30 445
Hewlett-Packard Co. (Plotters) See HP DeskJet entry for vendor information.	DesignJet 200	HP-GL/2, Ver. 2.0	Yes	N/A	No Yes (BBS, CIS)	No	None	None
	DesignJet 220	HP-GL/2, Ver. 2 0	Yes	N/A	No Yes (BBS, CIS)	No	None	None
	DesignJet 600	HP-GL/2, Ver 2.0	Yes	N/A	No Yes (BBS, CIS)	No	None	None
	DesignJet 650C	HP-GL/2, Ver 2 0	Yes	N/A	No Yes (BBS, CIS)	No	None	None
	DesignJet 650C/PS	HP-GL/2, Ver. 2.0	Yes	N/A	No Yes (BBS, CIS)	No	None	None
Lexmark Phone, 606-232-3000, fax, 606-232-2380, BBS 606-232-5238; CompuServe, GO LEXMARK; Internet, *ftp lexmark com;* Web site, *http://www.lexmark com/*	Color Jetprinter 4079 plus by Lexmark	Lexmark Color 4079 plus PS2, LEXPS DRV, Ver 3 10	No	Lexmark Color 4079 plus PS, PSCRIPT DRV	No Yes (BBS FTP, CIS, Web)	No	Lexmark Color 4079 plus PS, PSCRIPT DLL, Ver 3.51	Lexmark Color 4079 plus, PSCRIPT DRV, Ver. 30 435
	IBM 2380 Personal Printer II	IBM Personal Printer II 2380, IBM238X DRV, Ver. 2.3	No	IBM Personal Printer II 2380, IBM238X DRV	Yes No	Yes	IBM Personal Printer II 2380, IBM238X DLL, Ver. 1.10	IBM 2380 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2380 Plus Personal Printer II	IBM 2380 plus, IBM238X DRV, Ver 2.3	No	IBM 2380 Plus, IBM238X DRV	Yes No	Yes	IBM Personal Printer II 2380, IBM238X DLL, Ver 1.10	IBM 2380 PPS II, IBM42XX DRV Ver 2 387
	IBM 2381 Personal Printer II	IBM Personal Printer II 2381, IBM238X DRV, Ver 2 3	No	IBM Personal Printer II 2381, IBM238X DRV	Yes No	Yes	IBM Personal Printer II 2381, IBM238X DLL, Ver 1 10	IBM 2381 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2381 Plus Personal Printer II	IBM 2381 plus, IBM238X DRV, Ver 2.3	No	IBM 2381 Plus, IBM238X DRV	Yes No	Yes	IBM Personal Printer II 2381, IBM238X DLL, Ver 1 10	IBM 2381 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2390 Personal Printer II	IBM Personal Printer II 2390, IBM239X DRV, Ver 2.2	No	IBM Personal Printer II 2390, IBM239X DRV	Yes No	Yes	IBM Personal Printer II 2390, IBM239X DLL, Ver 3 10	IBM 2390 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2390 Plus Personal Printer II	IBM 2390 plus, IBM239X DRV, Ver 2.2	No	IBM 2390 Plus, IBM239X DRV	Yes No	Yes	IBM 2390 plus, IBM239X DLL, Ver 3 10	IBM 2390 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2390 PS/1	IBM 2390 PS/1, IBM239X DRV, Ver 2 2	No	IBM 2390 PS/1, IBM239X DRV	Yes No	Yes	IBM 2390 PS/1, IBM239X DLL, Ver 3 10	IBM 2390 PS/1, IBM42XX DRV Ver 2 387
	IBM 2391 Personal Printer II	IBM Personal Printer II 2391, IBM239X DRV, Ver 2 2	No	IBM Personal Printer II 2391, IBM239X DRV	Yes No	Yes	IBM Personal Printer II 2391, IBM239X DLL, Ver 3 10	IBM 2391 PPS II, IBM42XX DRV, Ver 2 387
	IBM 2391 Plus Personal Printer II	IBM 2391 plus, IBM239X DRV, Ver 2.2	No	IBM 2391 Plus, IBM239X DRV	Yes No	Yes	IBM 2391 plus, IBM239X DLL, Ver 3.10	IBM 2391 PPS II, IBM42XX DRV, Ver 2 387
	IBM 4070 IJ	IBM 4070 IJ, IBM4070 DRV, Ver 1.1	No	IBM 4070 IJ, CANON330.DRV	Yes No	Yes	IBM 4070 IJ, CANON330 DLL, Ver 2 13	IBM 4070 IJ, IBM42XX DRV, Ver 2 387
	IBM 4226 Model 302	IBM 4226 Model 302, IBM238X DRV, Ver 2.3	No	IBM 4226 Model 302, IBM238X DRV	Yes No	Yes	IBM Personal Printer II 2381, IBM238X DLL, Ver. 1 10	IBM 4226 Model 302, IBM42XX DRV, Ver. 2 387
	IBM Color Jetprinter 4079	IBM Color Jetprinter PS 4079, PSCRIPT DRV, Ver 3 58	No	IBM 4079 Color JetPrinter PS, PSCRIPT DRV	Yes No	No	IBM 4079 Color Jetprinter PS, PSCRIPT DLL, Ver 3 51	IBM 4079 Color Jetprinter PS, PSCRIPT DRV, Ver 30 442
	IBM ExecJet	IBM ExecJet, EXECJET DRV, Ver 1 0	No	IBM ExecJet 4072, CANON330 DRV	Yes No	Yes	IBM ExecJet 4072, CANON330 DLL, Ver 2 13	IBM 4072 ExecJet, IBM42XX DRV, Ver 2 387
	IBM ExecJet II	IBM 4076 ExecJet II, IBM4076 DRV, Ver 09 09 94	No	IBM ExecJet 4076 II, HPDSKJET DRV	Yes No	Yes	IBM ExecJet 4076 II, HPDSKJET DLL, Ver 3.10	IBM 4076 ExecJet II, IBMPCL3 DRV, Ver 2 209a
	IBM LaserPrinter 4019-001 and	IBM LaserPrinter 4019,	No	IBM 4019 Laserprinter,	Yes No	Yes	IBM 4019 LaserPrinter,	IBM 4019 LaserPrinter,
	IBM LaserPrinter 4019-E01	IBM4019 DRV, Ver 4 42		IBMPPDSL DRV			IBMPPDSL DLL, Ver 3 1	IBM4019 DRV, Ver 2 387
	IBM LaserPrinter 4029-5E	IBM LaserPrinter 4029-5E; IBM4029 DRV, Ver 4 42	No	IBM 4029 Laserprinter, IBMPPDSL DRV	Yes No	Yes	IBM 4029 LaserPrinter, IBMPPDSL DLL, Ver 3.1	IBM 4029 LaserPrinter 5E, IBM4019 DRV, Ver 2 387

N/A—Not applicable The current driver is Windows 95-compatible Note "Supported by OS" means that driver support is built into the operating system

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Printers

Continues

Company	Product name	Current driver (name, date, or version)	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	IBM LaserPrinter 4029 6	IBM LaserPrinter 4029 6, IBM4029 DRV Ver. 4.42	No	IBM 4029 Laserprinter IBMPPDSL DRV	Yes No	Yes	IBM 4029 LaserPrinter IBMPPDSL DLL Ver. 3.1	IBM 4029 LaserPrinter 6 IBM4019 DR Ver. 2.387
	IBM LaserPrinter 4029-10	IBM LaserPrinter 4029 10 IBM4029 DRV Ver. 4.42	No	IBM 4029 Laserprinter IBMPPDSL DRV	Yes No	Yes	IBM 4029 LaserPrinter, IBMPPDSL DLL Ver. 3.1	IBM 4029 LaserPrinter 10 IBM4019 DRV Ver. 2.387
	IBM LaserPrinter 4029 10L	IBM LaserPrinter 4029 10 IBM4u29.DRV, Ver. 4.42	No	IBM 4029 Laserprinter IBMPPDSL DRV	Yes No	Yes	IBM 4029 LaserPrinter IBMPPDSL DLL Ver. 3.1	IBM 4029 LaserPrinter 10L IBM4019 DRV, Ver. 2.387
	IBM LaserPrinter 4039-10D and	IBM 4039-10R Print Accelerator,	No	IBM 4039 Laserprinter	Yes No	Yes	IBM 4039 LaserPrinter,	IBM 4039 LaserPrinter 10R,
	IBM LaserPrinter 4039-10L	IBMPCL5 DRV, Ver. 94.08.12		HPPCL5MS DRV			HPPCL5MS DLL Ver. 3.20	IBMPCL5 DRV Ver. 2.209a
	IBM LaserPrinter 4039 12L	IBM 4039-12R Print Accelerator, IBMPCL5.DRV, Ver. 94.06.12	No	IBM 4039 Laserprinter HPPCL5MS DRV	Yes No	Yes	IBM 4039 LaserPrinter HPPCL5MS DLL Ver. 3.20	IBM 4039 LaserPrinter 12L IBMPCL5 DRV Ver. 2.209a
	IBM LaserPrinter 4039-12L plus	IBM 4039-12L plus Accelerator, LMPCL5B DRV, Ver. 95.04.10	No	IBM 4039 LaserPrinter plus, HPPCL5MS DRV	Yes Yes (BBS, FTP, CIS, Web)	Yes	IBM 4039 LaserPrinter plus, HPPCL5MS DLL Ver. 3.20	IBM 4039 LaserPrinter 12L plus IBMPCL5 DRV Ver. 2.209a
	IBM LaserPrinter 4039 12R	IBM 4039-12R Print Accelerator, IBMPCL5 DRV, Ver. 94.08.12	No	IBM 4039 Laserprinter HPPCL5MS DRV	Yes No	Yes	IBM 4039 LaserPrinter, HPPCL5MS DLL, Ver. 3.20	IBM 4039 LaserPrinter 12R IBMPCL5 DRV, Ver. 2.209a
	IBM LaserPrinter 4039-12R plus	IBM 4039-12R plus Accelerator, LMPCL5B DRV, Ver. 95.04.10	No	IBM 4039 LaserPrinter plus HPPCL5MS DRV	Yes Yes (BBS FTP CIS Web)	Yes	IBM 4039 LaserPrinter plus HPPCL5MS DLL Ver. 3.20	IBM 4039 LaserPrinter 12R plus IBMPCL5 DRV Ver. 2.209a
	IBM LaserPrinter 4039-16L	IBM 4039-16L Print Accelerator, IBMPCL5 DRV, Ver. 94.08.12	No	IBM 4039 LaserPrinter HPPCL5MS DRV	Yes No	Yes	IBM 4039 LaserPrinter HPPCL5MS DLL Ver. 3.20	IBM 4039 LaserPrinter 16L, IBMPCL5 DRV, Ver. 2.209a
	IBM LaserPrinter 4039-16L plus	IBM 4039-16L plus Accelerator, LMPCL5B DRV, Ver. 95.04.10	No	IBM 4039 LaserPrinter plus HPPCL5MS DRV	Yes Yes (BBS, FTP, CIS, Web)	Yes	IBM 4039 LaserPrinter plus HPPCL5MS DLL Ver. 3.20	IBM 4039 LaserPrinter 16L plus IBMPCL5 DRV Ver. 2.209a
	IBM Portable Printer 5183	IBM Portable 5183, IBM5183.DRV, Ver. 1.00	No	IBM Portable Printer 5183, CIT24US DRV	Yes No	Yes	IBM Portable 5183, IBMPORT DLL Ver. 1.0	IBM 5183 Portable Printer OMNI DRV, Ver. 30.437
	Lexmark ExecJet IIc	Lexmark 4076 Color IIc LXLXEC DRV Ver. 1.1.5	No	8/95	No Yes (BBS, FTP, CIS, Web)	Yes	IBM ExecJet 4076 IIc HPDSKJET DLL Ver. 3.10	Lexmark 4076 Color IBMPCL3 DRV, Ver. 2.209a
	Lexmark LaserPrinter 4039-10 plus	Lexmark 4039 10 plus LMPCL5B DRV Ver. 95.04.10	No	IBM 4039 LaserPrinter plus HPPCL5MS DRV	Yes Yes (BBS, FTP, CIS, Web)	Yes	Lexmark 4039 LaserPrinter plus HPPCL5MS DLL Ver. 3.20	Lexmark 4039 10 plus IBMPCL5 DRV Ver. 2.209a
	Lexmark Medley	Lexmark Medley Color LMMOM DRV Ver. 1.0	No	9/95	No No	Yes	None	None
	Lexmark Optra L	Lexmark Optra L, LMPCL5B DRV, Ver. 95.04.10	No	IBM Optra PCL1200 DRV	No Yes (BBS, FTP, CIS, Web)	Yes	Lexmark Optra PCL1200 DLL Ver. 2.21	Lexmark Optra L, IBMPCL5 DRV Ver. 2.209a
	Lexmark Optra Lx	Lexmark Optra Lx, LMPCL5B DRV, Ver. 95.04.10	No	IBM Optra PCL1200 DRV	No Yes (BBS FTP, CIS, Web)	Yes	Lexmark Optra PCL1200 DLL Ver. 2.21	Lexmark Optra Lx IBMPCL5 DRV Ver. 2.209a
	Lexmark Optra Lxu	Lexmark Optra Lxu, LMPCL5B DRV, Ver. 95.04.10	No	IBM Optra PCL1200 DRV	No Yes (BBS, FTP, CIS, Web)	Yes	Lexmark Optra, PCL1200 DLL Ver. 2.21	Lexmark Optra Lx, IBMPCL5 DRV Ver. 2.209a
	Lexmark Optra R	Lexmark Optra R LMPCL5B DRV, Ver. 95.04.10	No	IBM Optra PCL1200 DRV	No Yes (BBS, FTP, CIS, Web)	Yes	Lexmark Optra PCL1200 DLL Ver. 2.21	Lexmark Optra R, IBMPCL5 DRV Ver. 2.209a
	Lexmark Optra Rx	Lexmark Optra Rx, LMPCL5B DRV, Ver. 95.04.10	No	IBM Optra PCL1200 DRV	No Yes (BBS, FTP, CIS, Web)	Yes	Lexmark Optra, PCL1200 DLL, Ver. 2.21	Lexmark Optra Rx, IBMPCL5 DRV, Ver. 2.209a
	Lexmark ValueWriter 300 (or IBM 4037 5E)	IBM LP4037 5E, IBM4037 DRV, Ver. 1.41	No	Lexmark ValueWriter 300, IBMPPDSL DRV	Yes No	Yes	Lexmark ValueWriter 300 IBM PPDSL DLL, Ver. 3.1	IBM 4037 5E IBM4019 DRV Ver. 2.387
	Lexmark ValueWriter 600	Lexmark 4047 5E, LM4047 DRV, Ver. 95.01.03	No	Lexmark ValueWriter 600, HPPCL5MS DRV	Yes Yes (BBS, FTP, CIS, Web)	Yes	Lexmark ValueWriter 600 HPPCL5MS DLL Ver. 3.20	Lexmark 4047 5E IBMPCL5 DRV Ver. 2.209a
	Lexmark WinWriter 150c	Lexmark WinWriter 150c ColorFine 2, WWLXHB DRV	No	8/95	No Yes (BBS, FTP, CIS, Web)	Yes	None	None

N/A—Not applicable: The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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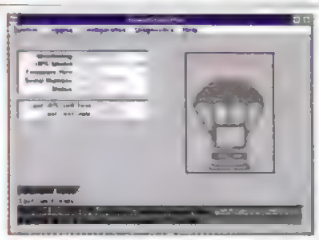

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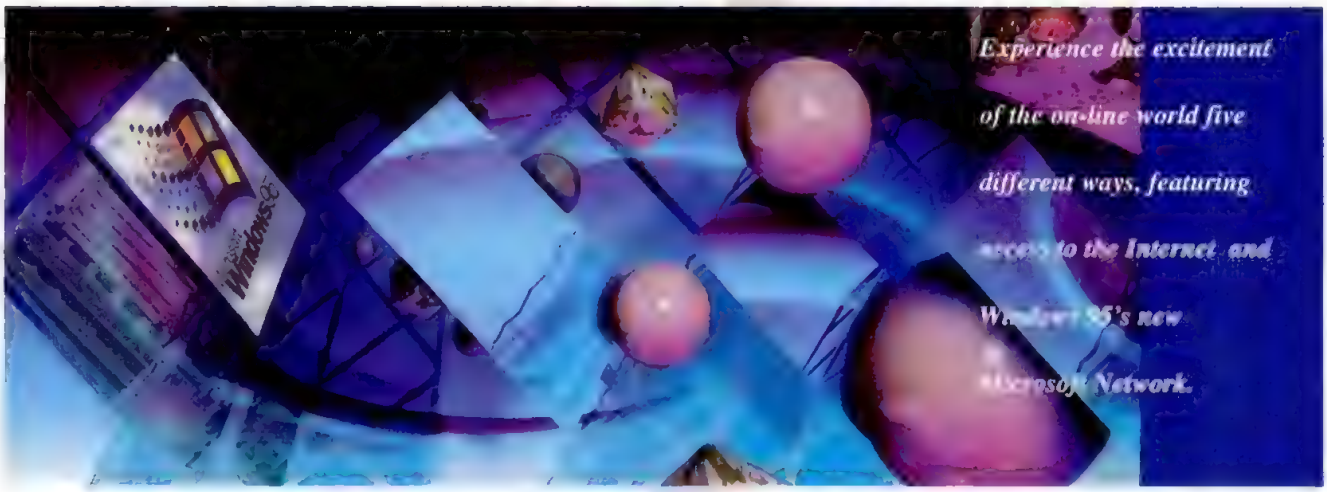

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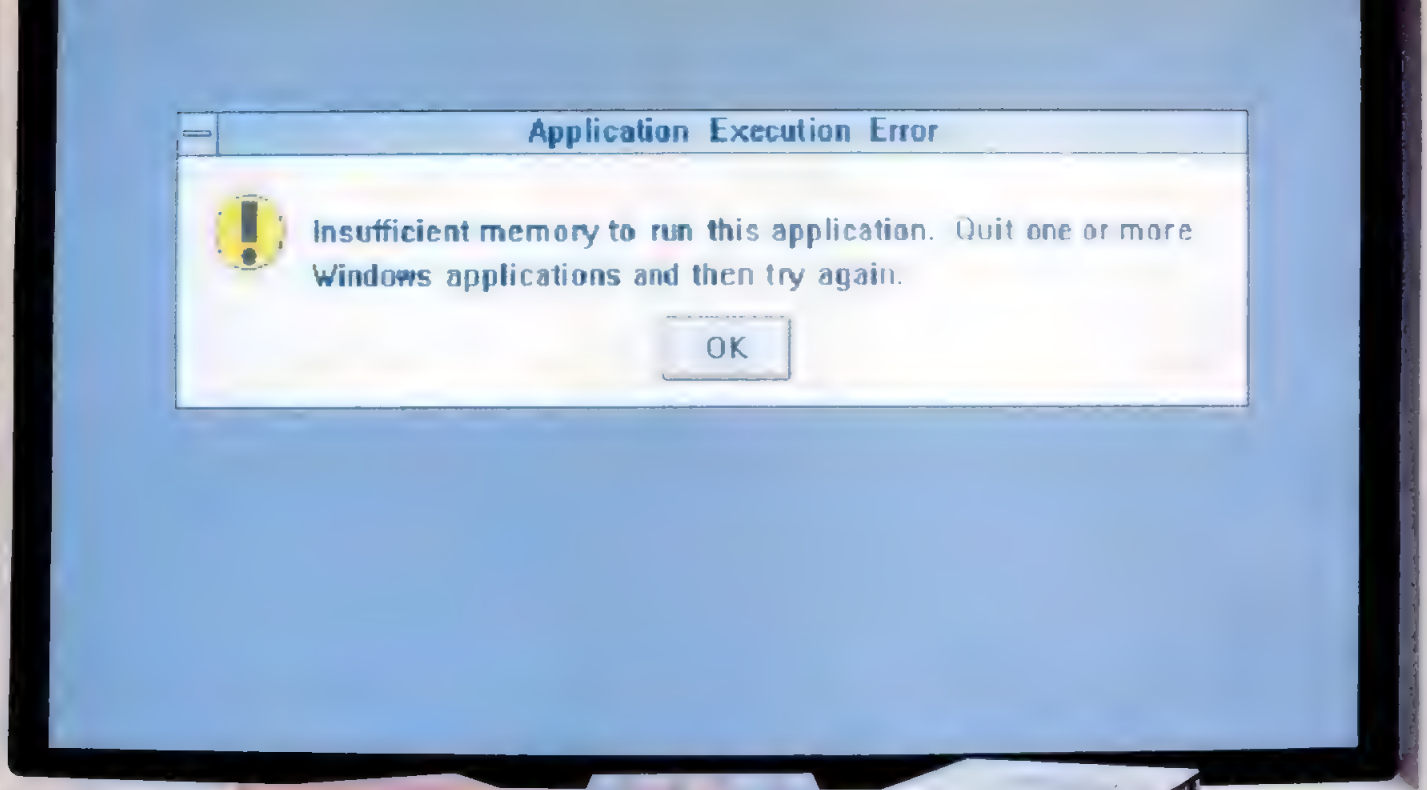

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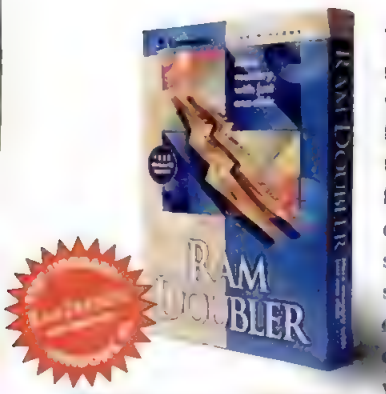

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Frees Memory Below 1MB	✓	✓		
Uses Compression To Double Application Memory Space	✓	✓	✓	✓
Doesn't Modify Autoexec.bat Or Config.sys.	✓			✓

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SYSTEM REQUIREMENTS: A PC equipped with a 386, 486, Pentium or equivalent processor. Windows 3.1 or 3.11, Windows for Workgroups 3.1 or 3.11, running in 386 enhanced mode. 4 MB RAM required, 8 MB RAM recommended. RAM Doubler for Windows works in tandem with any DOS memory extender, such as QEMM or Netroom. © 1995 Connectix Corporation. 2655 Campus Drive, San Mateo, CA 94403 USA. 800-839-3620 • 415-571 5100 • FAX 415-571 5195. RAM Doubler is a trademark of Connectix Corporation. All other trademarks are the property of their respective holders.

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SC-428PTL
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Printers

Continues

Company	Product name	Current driver (name, date, or version)	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	Lexmark WinWriter 200	Lexmark WinWriter 200, WPSLB DRV, Ver. 1.10 50 519	Yes	N/A	No No	Yes	None	None
	Lexmark WinWriter 400	Lexmark WinWriter 400 WPS[illegible] DRV Ver 1 10 50 522	Yes	N/A	No No	Yes	None	None
	Lexmark WinWriter 600	Lexmark WinWriter 600, WPSLX DRV, Ver 1 10 00 017	Yes	N/A	No No	Yes	None	None
NEC Phone 800 632 4636 fax 800 [illegible] 6416 American Center Nectech CompuServe GO NECTECH Internet *webmaster@nec.com* Website *http://www.nec.com*	Pinwriter P1200	Not named	Yes	N/A	No Yes (BBS AOL CIS)	Yes	None	None
	Silentwriter 95	Not named	Yes	N/A	Yes Yes (BBS AOL CIS)	No	Supported by OS	Supported by OS
	Silentwriter 97	Not named	Yes	N/A	Yes Yes (BBS AOL CIS)	No	Supported by OS	Supported by OS
	Silentwriter 1097	Not named	Yes	N/A	Yes Yes (BBS AOL CIS)	No	Supported by OS	Supported by OS
	Silentwriter SuperScript 610	Not named	Yes	N/A	Yes Yes (BBS AOL CIS)	Yes	None	None
	Silentwriter SuperScript 610 plus	Not named	Yes	N/A	No Yes (BBS AOL CIS)	Yes	None	None
	Silentwriter SuperScript 660	Not named	Yes	N/A	No Yes (BBS AOL CIS)	Yes	None	None
	Silentwriter SuperScript 660i	Not named	Yes	N/A	No Yes (BBS AOL CIS)	Yes	None	None
	SuperScript Color 3000	Not named	Yes	N/A	Yes Yes (BBS, AOL CIS)	Yes	None	None
Okidata Phone 800 654 3282 fax 609 [illegible] 2779 BB[illegible] 654 5344 CompuServe GO OKIBMHW	Microline 395	epson395.drv ibm395.drv 2.28/95	Yes	N/A	No Yes (BBS CIS)	Yes	None	None
	Microline 520/521	epson520.drv ibm520.drv ibm520.drv, 3/25/93	Yes	N/A	No Yes (BBS CIS)	Yes	None	None
	Okipet 2010	Not named	Yes	N/A	No No	Yes	None	None
	OL400e	ol400e.drv, 10/2[illegible]/93	Yes	N/A	No Yes (BBS CIS)	Yes	OKI410e.DLL, Ver 1.0	None
	OL410e	ol410e.drv, [illegible]/2/93	Yes	N/A	No Yes (BBS CIS)	Yes	OL400E.DLL Ver 1.0	None
	OL410e/PS	ol410eps.drv 6/8/94	Yes	N/A	No Yes (BBS, CIS)	Yes	None	None
	OL810e	ol810e.drv 4/7/94	Yes	N/A	No Yes (BBS CIS)	Yes	None	None
	OL830 Plus	ol830525.wpd 2/[illegible]/93	Yes	N/A	No Yes (BBS CIS)	Yes	None	None
	OL850	ol850[illegible].wpd 2/[illegible]/93	Yes	N/A	No Yes (BBS CIS)	Yes	None	None
	OL1200	Not named	Yes	N/A	No No	Yes	None	None
Panasonic Communications & Systems Company Phone 800 [illegible] 564 fax 800 [illegible] 4 BBS 201 863 7845	KX-P1150	PANSONS DRV ver 3.0	Yes	N/A	Yes Yes (BBS)	Yes	None	None
	KX-P2023	PANSON24 DRV Ver 3.0	Yes	N/A	Yes Yes (BBS)	Yes	None	None
	KX-P2130	PAN24_1.7 DRV ver [illegible]	No	None	No Yes (BBS)	Yes	None	None
	KX-P2135	PAN24_1.7 DRV ver 1.7	No	None	No Yes (BBS)	Yes	None	None
	KX-P3123	ESCP2MS DRV ver [illegible]	Yes	N/A	Yes Yes (BBS)	Yes	None	None
	KX-P3124	ESCP2MS DRV Ver 3.27	Yes	N/A	Yes Yes (BBS)	Yes	None	None
	KX-P3624	PASCALE DRV ver 1.6	No	None	No Yes (BBS)	Yes	None	None
	KX-P3626	PASCALE DRV ver 1.6	No	None	No Yes (BBS)	Yes	None	None
	KX-P3696	PASCALE DRV ver 1.6	No	None	No Yes (BBS)	Yes	None	None
	KX-P4400	HPPCL DRV Ver 3.1	Yes	N/A	Yes Yes (BBS)	Yes	None	None
	KX-P4440	HPPCL5MS DRV ver 3.78	Yes	N/A	Yes Yes (BBS)	Yes	HPPCL5MS DRV Ver 3.2	None
	KX-P5400	PAP54001 PPD 6/21/95	Yes	N/A	Yes Yes (BBS)	Yes	PAP54001 DRV, 2/10/95	None
	KX-P5410	PAP54101 PPD 6/21/95	Yes	N/A	Yes Yes (BBS)	Yes	PAP5410 DRV 2/10/95	None
	KX-P6100	Ver 1.27	No	None	No Yes (BBS)	Yes	None	None
	KX-P[illegible]50	PAN[illegible] DRV	No	None	No Yes (BBS)	Yes	None	None

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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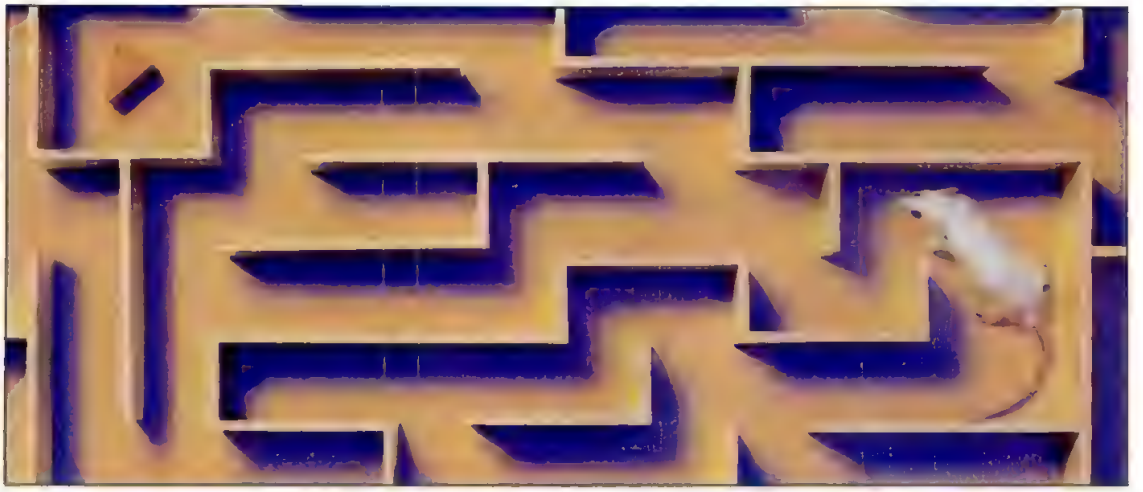
CIRCLE 141 ON READER SERVICE CARD



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CIRCLE 059 ON READER SERVICE CARD

Printers *Continued*

Company	Product name	Current driver (name, date, or version)	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	[illegible]	[illegible]	No	None	No Yes (BBS)	Yes	None	None
QMS [illegible]	[illegible]	[illegible]	No	None	No No	No	Supported by OS	Supported by OS
	QMS 420 Print System	QMS [illegible]	No	None	No No	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 860 Print System	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 1060E Print System	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 1660E Print System	QMS Level 2 [illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	Yes Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	Yes Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 2025 Kanji Print System	QMS Level 2 Windows driver, 9/20/95	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 2025 Print System	QMS Level 2 Windows driver, 9/20/95	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 2025 Turbo Imaging System	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 3225 Print System	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	QMS 3225 Turbo Imaging System	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible] Windows driver, 9/20/95	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	QMS Level 2 Windows Driver 8/2/95	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	QMS Level 2 Windows Driver, [illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS
	[illegible]	[illegible]	Yes	N/A	No Yes (BBS CIS Web)	No	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means that drivers support is built into the operating system.

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CIRCLE 126 ON READER SERVICE CARD

Printers

Ends

Company	Product name	Current driver (name, date, or version)	Win 95-compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Uses 32-bit sub-system and EMF	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
Tektronix Phone 800-835-6100 fax [illegible] BBS [illegible]-835-4504 America Online Tektronix Internet support@colorprinters [illegible] Web site, *http://www.tek.com/Color_Printers/*	Phaser IIsd	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser IIsdx	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser IIpx	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 140	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 200e	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 200i	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 220e	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 220i	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 240	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 300i	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 340	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 440	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 480	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 480x	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 540	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	Phaser 540 Plus	Phaser drv, Ver 3.58	Yes	N/A	Yes Yes (BBS, AOL, CIS, Web)	No	Supported by OS	Supported by OS
	microLaser 600	PSCRIPT DRV (emulation)	Yes	N/A	No No	No	Supported by OS	None
Texas Instruments Phone [illegible] fax [illegible] BBS [illegible] America Online TI CompuServe GO TIFORUM Internet [illegible]@msg.ti.com, Web site, *http://www.ti.com*	microLaser Basic	TIMLPCL4 DRV, 4/27/93 (emulation)	Yes	N/A	No No	No	None	None
	microLaser Power Pro	PSCRIPT DRV (emulation)	Yes	N/A	No No	No	None	None
	microLaser Pro E	PSCRIPT DRV (emulation)	Yes	N/A	No No	No	None	None
	microLaser Pro 600 PS 23	PSCRIPT DRV (emulation)	Yes	N/A	Yes No	No	Supported by OS	Supported by OS
	microLaser Pro 600 PS 35	PSCRIPT DRV (emulation)	Yes	N/A	Yes No	No	Supported by OS	Supported by OS
	microLaser PS 17	PSCRIPT DRV (emulation)	Yes	N/A	Yes No	No	Supported by OS	Supported by OS
	microLaser PS 35	PSCRIPT DRV (emulation)	Yes	N/A	Yes No	No	Supported by OS	Supported by OS
	microMarc	TIMMPCL3 DRV, 4/7/94 (emulation)	Yes	N/A	No No	No	None	None
	microMarc Color	TITIMM DRV, 6/13/94 (emulation)	Yes	N/A	No No	No	None	Supported by OS
	microWriter Basic	TIMLPCL4 DRV, 4/27/93	Yes	N/A	No No	No	Supported by OS	None
	microWriter PS 23	PSCRIPT DRV (emulation)	Yes	N/A	No No	No	None	Supported by OS
	microWriter PS 85	PSCRIPT DRV (emulation)	Yes	N/A	No No	No	None	Supported by OS
	TI Model 830	PROPRINT DRV (emulation)	Yes	N/A	No No	No	None	None
	TI Model 835	PROPRINT DRV (emulation)	Yes	N/A	No No	No	None	None
Xerox Corp Phone [illegible] fax [illegible] CompuServe [illegible] Web site, *http://www.[illegible]*	Xerox 4520 Desktop Laser Printer	X45XX DRV Ver 1.1.0	Yes	N/A	No Yes (CIS, Web)	No	XRx4500 DLL Ver 3.3	XRXPCL5E DRV Ver 1.2.0
	Xerox 4520 Desktop Laser Printer	X45XX DRV Ver 4.4.5E	Yes	N/A	No Yes (CIS, Web)	No	Supported by OS	Supported by OS
	Xerox 4520 Desktop Laser Printer	X45XX DRV Ver 1.1.0	Yes	N/A	No Yes (CIS, Web)	No	XRx4500 DLL Ver 3.3	XRXPCL5E DRV Ver 1.2.0
	Xerox 4520 Desktop Laser Printer	X45XX DRV Ver 4.4.5E	Yes	N/A	No Yes (CIS, Web)	No	Supported by OS	Supported by OS
	Xerox 4520 Desktop Laser Printer	X45XX DRV Ver 1.1.0	Yes	N/A	No Yes (CIS, Web)	No	XRx4500 DLL Ver 3.3	XRXPCL5E DRV Ver 1.2.0
	Xerox 4520mp Desktop Laser Printer	X45XX DRV, Ver 4.4.5E	Yes	N/A	No Yes (CIS, Web)	No	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means that driver support is built into the operating system.

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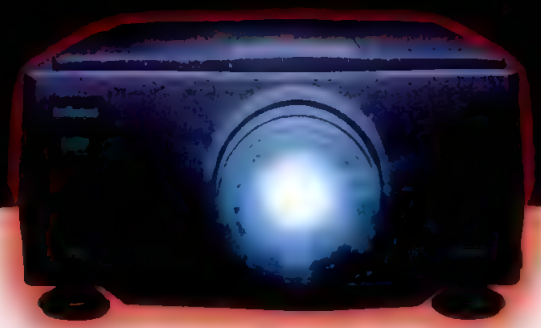

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Quarterdeck

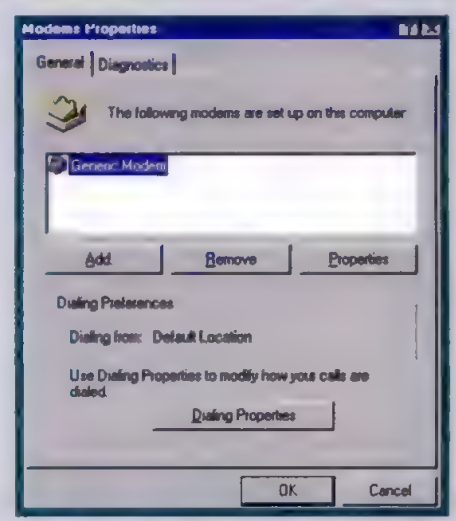
Modems

The task of maintaining compatibility with a variety of modems has long rested on the shoulders of the communications application. And although most modems conform to the Hayes-modem standard AT command set, there are almost as many deviations as there are modems; buy a new modem, reconfigure your application. For 32-bit applications, Windows 95 changes that.

While 16-bit applications will continue to work with modems pretty much as they did under Windows 3.1, 32-bit applications will be able to take advantage of the new telephony API (TAPI). Windows 3.1 offered UNIDRV to ease printer support; Windows 95 tries to do the same for modems with its new Unimodem modem driver. This driver works with both TAPI and VCOMM (a Windows 95 low-level communication driver that provides hooks into communication devices such as modems, LPT ports, and COM ports). Unimodem takes the TAPI commands from communications applications and translates them into AT commands (or whatever command the modem understands).

A modem vendor can support the driver by writing a simple text or .INF file. Within this file will be the command strings necessary to communicate with the modem, and other specifications such as modem name, manufacturer, capabilities, and initialization commands.

Windows 95 will also ship with almost 800 modem descriptions, and it may be able to auto-detect your modem.—*Lance Ulanoff*



Access this dialog box by double-clicking on the Modem icon in Windows 95's Control Panel (found by clicking on the My Computer icon). If you can't find your modem among those listed here, you can add it to the list (if your modem vendor provides the requisite .INF file).

THE DRIVER MANUAL

Modems

Company	Product name	.INF file bundled with Win 95	.INF file on-line	.INF filename	Uses Windows NT 3.5 native communication APIs	Uses OS/2 Warp native communication APIs
American Data Technology Inc. Phone, 818-303-8567; fax, 818-303-0610	WM-1414ACV	Yes	No	SFM.INF	Yes	Yes
	WM-1414AR	Yes	No	SFM.INF	Yes	Yes
	WM-1414ARL	Yes	No	SFM.INF	Yes	Yes
	WM-1414ARN	Yes	No	SFM.INF	Yes	Yes
	WM-1414BR	Yes	No	SFM.INF	Yes	Yes
	WM-1414BRL	Yes	No	SFM.INF	Yes	Yes
	WM-1414BRN	Yes	No	SFM.INF	Yes	Yes
	WM-1414CRN	Yes	No	SFM.INF	Yes	Yes
	WM-3417AR	Yes	No	SFM.INF	Yes	Yes
	WM-3417ARN	Yes	No	SFM.INF	Yes	Yes
	WM-3417BR	Yes	No	SFM.INF	Yes	Yes
	WM-3417BRN	Yes	No	SFM.INF	Yes	Yes
	WM-3417CR	Yes	No	SFM.INF	Yes	Yes
	WM-3417CRN	Yes	No	SFM.INF	Yes	Yes
AT&T Phone, 800 582 3333, fax, 813 530-2103, BBS, 813 532-5254, CompuServe, GO DP; Web site, *http://www.paradyne.att.com*	AT&T COMShere 3800PLUS Series	Yes	No	See Win 95's modem list	Yes	No
	AT&T DataPort 14.4-fax	Yes	No	See Win 95's modem list	Yes	No
	AT&T DataPort 2001	Yes	No	See Win 95's modem list	Yes	No
	AT&T DataPort Express	Yes	No	See Win 95's modem list	Yes	No
	AT&T KeepInTouch Card	Yes	No	See Win 95's modem list	Yes	No
	AT&T KeepInTouch Express Card	Yes	No	See Win 95's modem list	Yes	No
	AT&T KeepInTouch Express Card 28 8	Yes	No	See Win 95's modem list	Yes	No
Best Data Products Inc. Phone, 818-773-9600; fax, 818-773-9619, BBS, 818-773-9627; America Online, Best Data	1442F	Yes	No	MDMROCK.INF	Yes	Yes
	1442FC	Yes	No	MDMROCK.INF	Yes	Yes
	1442FCX	Yes	No	MDMROCK.INF	Yes	Yes
	1442FQ	Yes	No	MDMROCK.INF	Yes	Yes
	1442FTX	No	No	N/A	Yes	Yes
	1442VFT	Yes	No	MDMROCK.INF	Yes	Yes
	2834F	Yes	No	MDMROCK.INF	Yes	Yes
	2834FX	Yes	No	MDMROCK.INF	Yes	Yes
	9624FQ	Yes	No	MDMROCK.INF	Yes	Yes
	ACE 5000	Yes	No	MDMROCK.INF	Yes	Yes

N/A—Not applicable. No .INF file is available

Modems

Continues

Company	Product name	.INF file bundled with Win 95	.INF file on-line	.INF filename	Uses Windows NT 3.5 native communication APIs	Uses OS/2 Warp native communication APIs
Boca Research Inc. Phone 407 997 6227, fax 407 997 0918 BBS 407 241 1601, CompuServe GO BOCA, Internet, *sales@boca.org;* Web site, *http://www.boca.org*	14.4 Kbps Multimedia Voice Modem/FDV 141	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	96/24 fax modem/FM96ED	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	96/24 fax modem/FM96ID	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	2400 Modem/M024ED	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	2400 Modem/M024ID	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem/M144MA	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem/MV 34	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem/MV 34E	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem/MV 34ED	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem with Fax, M144EW	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	BocaModem with Fax/M144IW	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	Complete Office Communicator/CC0141	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	Multimedia Modem/FDV 24E	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	Multimedia Modem/FDV 241	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	Multimedia Voice Modem with VoiceView/FDVV141	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
	On-Line Express/M144A1	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	On-Line Express/M144AE	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	Pocket Modem 14.4Kbps/PM144D	No	Yes (CIS)	See CompuServe forum	Yes	Yes
	SoundExpress on/SE1440	Yes	Yes (CIS)	See CompuServe forum	Yes	Yes
Computer Peripherals Inc. Phone 714 454 2441 fax 714 454 8527, BBS, 714 454 8124 America Online CPI001 CompuServe 76004 2306, Internet *vivamodem@delphi.com*	Hook-Up 2400e	Yes	No	MDMCPI.INF	Yes	No
	Hook-Up 2400s	Yes	No	MDMCPI.INF	Yes	No
	Hook-Up 2400 SC	No	No	N/A	No	No
	ViVa 14.4 External Data/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 14.4 Internal Data/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 14.4 Internal Data/fax/Voice	Yes	No	MDMCPI.INF	Yes	No
	ViVa 14.4e/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 14.4i/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 14.4 PCMCIA	Yes	No	MDMCPI.INF	Yes	No
	ViVa 24e	Yes	No	MDMCPI.INF	Yes	No
	ViVa 24i	Yes	No	MDMCPI.INF	Yes	No
	ViVa 24ifx	No	No	N/A	No	No
	ViVa 24im	Yes	No	MDMCPI.INF	Yes	No
	ViVa 24m	Yes	No	MDMCPI.INF	Yes	No
	ViVa 28.8/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 28.8i/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 2400p	No	No	N/A	No	No
	ViVa 2442e	No	No	N/A	No	No
	ViVa 2442ef	No	No	N/A	No	No
	ViVa 2442i	No	No	N/A	No	No
	ViVa 2442if	Yes	No	MDMCPI.INF	Yes	No
	ViVa 2496ef	No	No	N/A	No	No
	ViVa 2496e/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa 2496if	No	No	N/A	Yes	No
	ViVa 9642e	No	No	N/A	No	No
	ViVa 9642if	No	No	N/A	No	No
	ViVa Internal Data/fax	Yes	No	MDMCPI.INF	Yes	No
	ViVa Message Center	Yes	No	MDMCPI.INF	Yes	No
E-Tech Research Inc. Phone 408 988 8108 fax 408 988 9109, BBS, 408-988 3663, Web site, *http://www.e-tech.com*	Bullet 100E	Yes	No	MDMROCK2.INF	Yes	Yes
	Bullet C1414AX	No	Yes (BBS)	C1414AX.INF	No	Yes
	Bullet C1414CX	Yes	No	MDMROCK2.INF	No	Yes
	Bullet E288MX	Yes	No	MDMROCK2.INF	Yes	Yes
	Bullet E1414MX	No	Yes (BBS)	E1414MX.INF	Yes	Yes
	Bullet PC192MX	No	Yes (BBS)	PC192MX.INF	Yes	Yes
	Bullet PC288MX	Yes	No	MDMROCK2.INF	Yes	Yes
	Bullet PC1414MX	No	Yes (BBS)	PC1414MX.INF	Yes	Yes
	Bullet PC1414JX	Yes	No	MDMROCK2.INF	Yes	Yes
Hayes Microcomputer Products Inc. Phone 404 441-0896 fax 404 441 1213, BBS, 404-446-6336, CompuServe, GO HAYES	Hayes Accura 144 + fax144	Yes	No	See Win 95's modem list	No	No
	Hayes Accura 144B + fax144	Yes	No	See Win 95's modem list	No	No
	Hayes Accura 288 V.34, V.FC + fax	Yes	No	See Win 95's modem list	No	No
	Optima 144 + fax144	Yes	No	See Win 95's modem list	No	No

N/A—Not applicable. No .INF file is available

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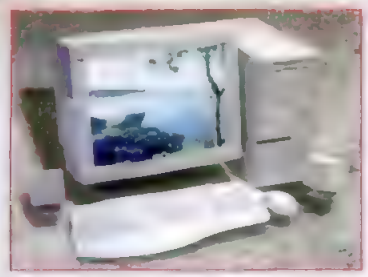

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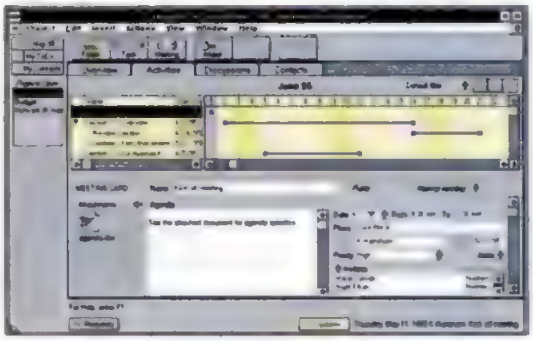

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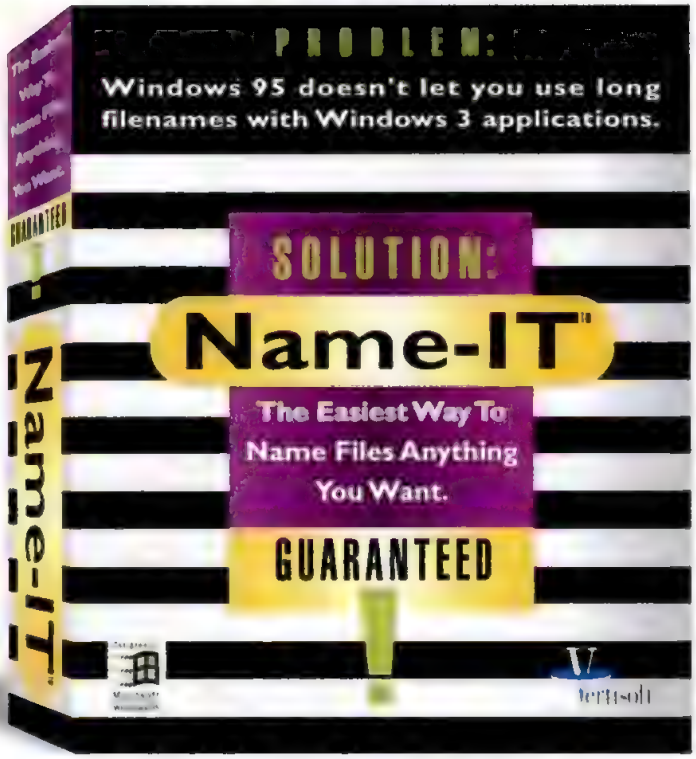

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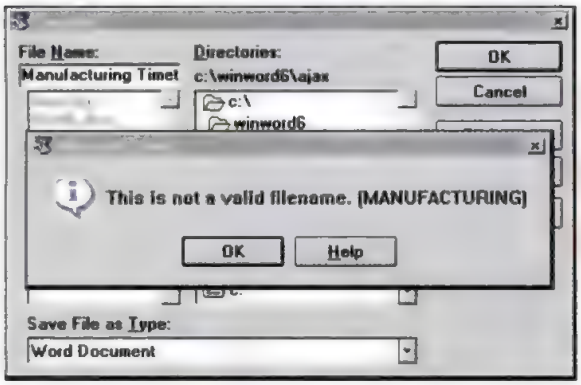
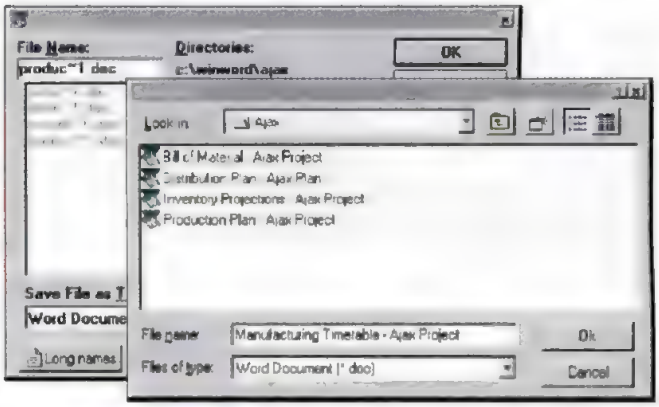


BEFORE ▶ *Without Name-IT, Windows 3.1 applications can't use long file names in Windows 95.*



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Modems

Continues

Company	Product name	.INF file bundled with Win 95	.INF file on-line	.INF filename	Uses Windows NT 3.5 native communication APIs	Uses OS/2 Warp native communication APIs
	Optima 144 + fax144 PCMCIA	Yes	No	See Win 95's modem list	No	No
	Optima 144 + fax144 Pocket Edition	Yes	No	See Win 95's modem list	No	No
	Optima 144B + fax144	Yes	No	See Win 95's modem list	No	No
	Optima 288 V.34 + fax	Yes	No	See Win 95's modem list	No	No
	Optima 288 V.34 + fax PCMCIA	Yes	No	See Win 95's modem list	No	No
	Optima 288 V.34 + fax + Voice	Yes	No	See Win 95's modem list	No	No
	Optima 288 V.FC + fax	Yes	No	See Win 95's modem list	No	No
	Optima 288 V.FC + fax (UK)	Yes	No	See Win 95's modem list	No	No
	Optima 288B V.FC + fax	Yes	No	See Win 95's modem list	No	No
Logicode Technology Inc. Phone 805-388-9000 fax 805-388-8991, BBS, 805-445-9633; America Online, *logicode@aol.com*	Quicktel 14V14HV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 14V14PC	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 14V14XV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 14.4HV	No	No	N/A	Yes	Yes
	Quicktel 14.4XV	No	No	N/A	Yes	Yes
	Quicktel 96XV	No	No	N/A	Yes	Yes
	Quicktel 1414HV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 1414LH	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 1414XV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 2400 (external)	No	No	N/A	Yes	Yes
	Quicktel 2400 (internal)	No	No	N/A	Yes	Yes
	Quicktel 2814HV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 2814XV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 9624H	No	No	N/A	Yes	Yes
	Quicktel 9624HV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 9624LH	No	No	N/A	Yes	Yes
	Quicktel 9624LX	No	No	N/A	Yes	Yes
	Quicktel 9624XV	Yes	Yes (BBS)	MDMROCK.INF	Yes	Yes
	Quicktel 9696HV	No	No	N/A	Yes	Yes
	Quicktel 9696XV	No	No	N/A	Yes	Yes
	Quicktel Pocket modem	No	No	N/A	Yes	Yes
Motorola Information Systems Group Phone 800-487-1456, 508-261-4000, BBS, 508-261-1058, Web site, *http://www.motorola.com/MIMS/ISG/*	326XFast V.34	Yes	No	MDMMOTO.INF	No	No
	326XFast V.34 SDC	Yes	No	MDMMOTO.INF	No	No
	Lifestyle Series 14.4 PCMCIA	Yes	No	MDMMOTO.INF	No	No
	Lifestyle Series 28.8	Yes	No	MDMMOTO.INF	No	No
	Lifestyle Series 28.8 ISA PC Card	Yes	No	MDMMOTO.INF	No	No
	Power Class 14.4 PCMCIA	Yes	No	MDMMOTO.INF	No	No
	Power Class 28.8	Yes	No	MDMMOTO.INF	No	No
	V.3400	Yes	No	MDMMOTO.INF	No	No
Multi-Tech Systems Inc. Phone 612-785-3500 fax, 612-785-9874, BBS, 612-785-3702, CompuServe, 76004,3535; Internet, *sales@multitech.com*; Web site, *http://www.multitech.com*	MT56DSU/R	No	No	N/A	No	No
	MT932/BA	No	No	N/A	No	No
	MT932BC	No	No	N/A	No	No
	MT932BR	No	No	N/A	No	No
	MT1432BA	Yes	No	MTS Modem.INI	No	No
	MT1432BC	No	No	N/A	No	No
	MT1432BLR	No	No	N/A	No	No
	MT1432BR	No	No	N/A	No	No
	MT1432LT	Yes	No	MTS Modem.INI	No	No
	MT1432MR	No	No	N/A	No	No
	MT1432MU	No	No	N/A	No	No
	MT1932BL	No	No	N/A	No	No
	MT1932PCS	Yes	No	MTS Modem.INI	No	No
	MT1932ZDX	Yes	No	MTS Modem.INI	No	No
	MT1932ZPX	Yes	No	MTS Modem.INI	No	No
	MT2834BA	Yes	No	MTS Modem.INI	No	No
	MT2834BC	No	Pending	Pending (4th qtr. 1995)	No	No
	MT2834BL	Yes	No	MTS Modem.INI	No	No
	MT2834BLR	No	No	N/A	No	No
	MT2834BR	No	No	N/A	No	No
	MT2834LT	Yes	No	MTS Modem.INI	No	No
	MT2834MR	No	No	N/A	No	No
	MT2834PCS	Yes	No	MTS Modem.INI	No	No
	MT2834PCS/c	Yes	No	MTS Modem.INI	No	No

N/A—Not applicable. No .INF file is available

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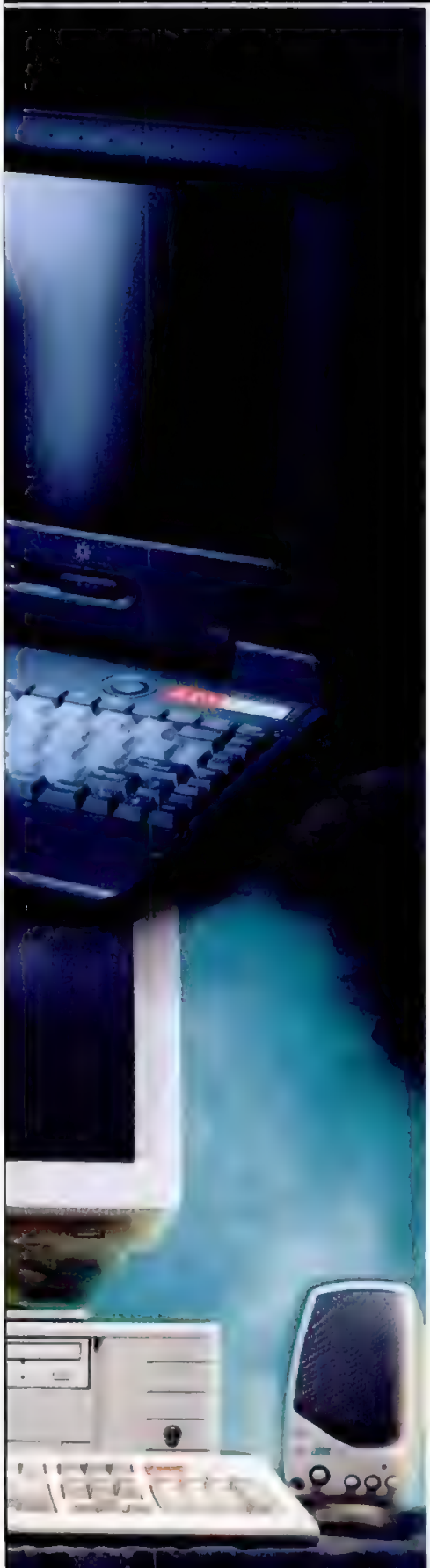

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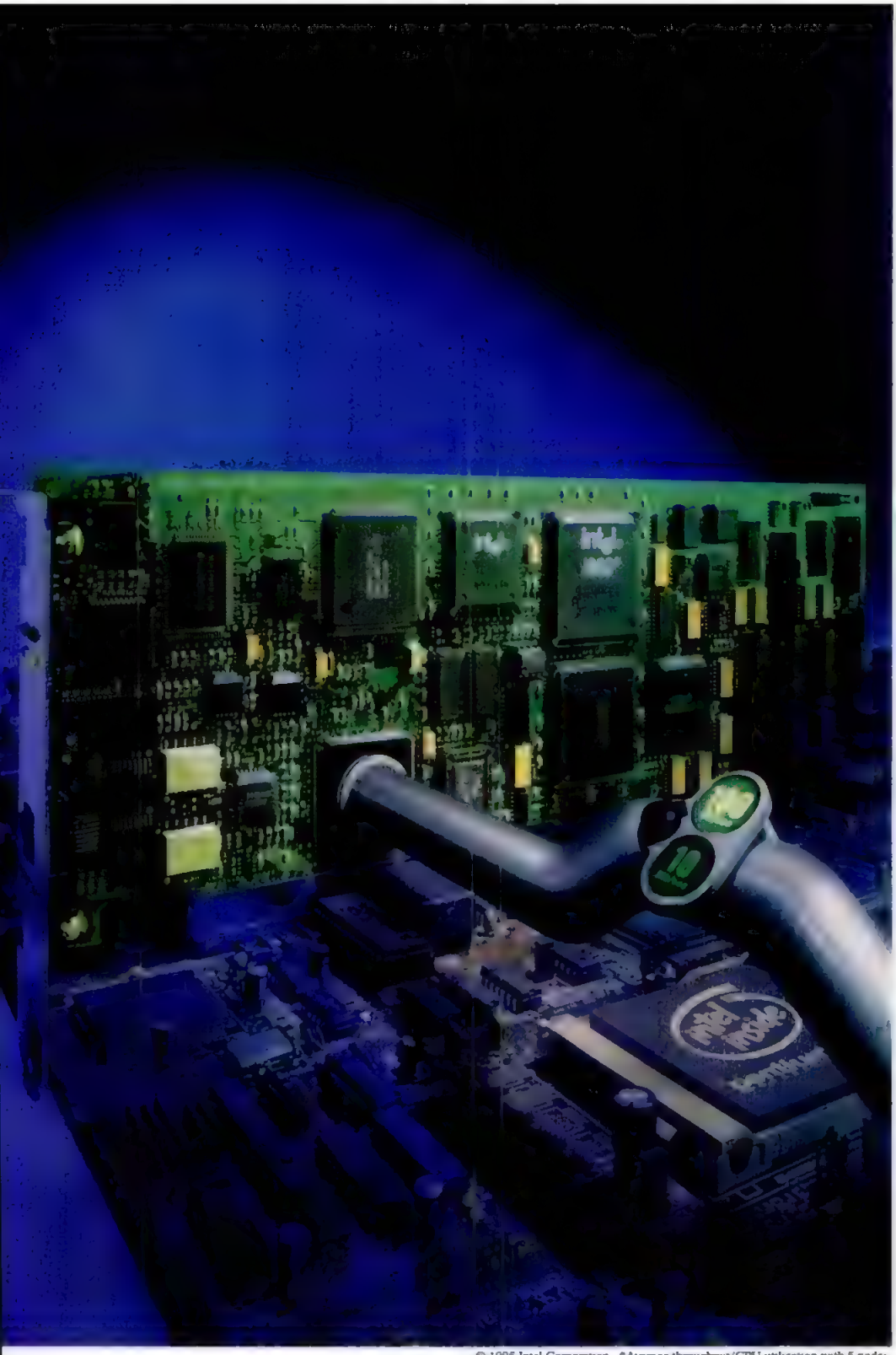
CIRCLE 134 ON READER SERVICE CARD

Modems

Continues

Company	Product name	.INF file bundled with Win 95	.INF file on-line	.INF filename	Uses Windows NT 3.5 native communication APIs	Uses OS/2 Warp native communication APIs
	MT2834ZDX	Yes	No	MTS Modem.INI	No	No
	MT2834ZPX	No	Pending	Pending (4th quarter 1995)	No	No
	MT2834ZPX/W	No	Pending	Pending (4th quarter 1995)	No	No
Practical Peripherals Phone, 404-840-9966, fax, 404-734-4601; BBS, 404-734-4600	PC144HC II	Yes	No	See Win 95's modem list	No	No
	PC144T2	No	No	N/A	No	No
	PC144T2-EZ	Yes	No	See Win 95's modem list	No	No
	PC288HC V 34	Yes	No	See Win 95's modem list	No	No
	PC288LCD V 34	Yes	No	See Win 95's modem list	No	No
	PC288MT V 34	Yes	No	See Win 95's modem list	No	No
	PC288T2 V 34	No	No	N/A	No	No
	PC288T2-EZ V.34	Yes	No	See Win 95's modem list	No	No
	PC2144MT II	Yes	No	See Win 95's modem list	No	No
	PM144HC II	Yes	No	See Win 95's modem list	No	No
	PM144MT II	Yes	No	See Win 95's modem list	No	No
	PM288HC II V.34	Yes	No	See Win 95's modem list	No	No
	PM288MT II V 34	Yes	No	See Win 95's modem list	No	No
	PM2400FX Mini	Yes	No	See Win 95's modem list	No	No
	PM9600MT II	Yes	No	See Win 95's modem list	No	No
Supra Corp. Phone, 360-604-1400, fax, 360-604-1401, America Online, Supracorp2, CompuServe, GO SUPRA, Internet, *supratech@supra com*, Web site, *http //www supra com*	RMD 3222 Modem	No	Pending	Pending (10/95)	No	No
	RMD 3232 Plus Modem	No	Pending	Pending (10/95)	No	No
	RMD 3264	No	Pending	Pending (10/95)	No	No
	SupraCOMCard	Yes	No	mdmsupra inf	Yes	Yes
	SupraExpress 144i Pnp	Yes	No	mdmsupra inf	Yes	Yes
	SupraExpress Plus	Yes	No	mdmsupra inf	Yes	Yes
	SuprafaxModem 144i	Yes	No	mdmsupra inf	Yes	Yes
	SuprafaxModem 144LC	Yes	No	mdmsupra inf	Yes	Yes
	SuprafaxModem 288	Yes	No	mdmsupra.inf	Yes	Yes
	SuprafaxModem 288i PnP	Yes	No	mdmsupra inf	Yes	Yes
	SuprafaxModem V 32bis	Yes	No	mdmsupra.inf	Yes	Yes
Telebit Corp. Phone, 800-835-3248, fax, 408-734-3333, BBS, 408-745-3861; America Online, Mail Telebit TS, CompuServe, GO TELEBIT; Internet, *info@telebit com*, Web site, *http://www telebit com*	FastBlazer 8840	Yes	No	See Win 95's modem list	Yes	No
	T2500	Yes	No	See Win 95's modem list	Yes	No
	T3000	Yes	No	See Win 95's modem list	Yes	No
	TeleBlazer	Yes	No	See Win 95's modem list	Yes	No
	Tra lBlazer	Yes	No	See Win 95's modem list	Yes	No
	WorldBlazer	Yes	No	See Win 95's modem list	Yes	No
	Xpresso 8196A	No	Yes (Web)	Not named	No	No
	Xpresso 8396A	No	Yes (Web)	Not named	No	No
U.S. Robotics Phone, 800-342-5877; fax, 708-676-7320; BBS, 708-982-5092, CompuServe, GO USROBOTICS, Internet, *salesinfo@usr com*, Web site, *http //www usr com*	Courier 14 4 PCMCIA PC Card	Yes	Yes (BBS)	mdmusrcr.inf	No	No
	Courier 14 4 PCMCIA PC Card with DataView	No	Yes (BBS)	mdmusrcr.inf	No	No
	Courier Dual Standard V Everything with V.34	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier HST 16 B	Yes	Yes (BBS)	mdmusrcr.inf	No	No
	Courier HST 16 B fax	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier HST Dual Standard fax with V32terbo	Yes	Yes (BBS)	mdmusrcr.mf	No	No
	Courier HST Dual Standard fax with V 32bis	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier HST Dual Standard PS/2 fax with V.32bis	No	No	N/A	No	No
	Courier V 32bis	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier V 32 bis/PS/2 fax	No	No	N/A	No	No
	Courier V Everything with V 34 PCMCIZ PC Card	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier V Everything with V 34 PCMCIA PC Card with DataView	No	Yes (BBS)	mdmusrcr inf	No	No
	Courier V 32bis fax	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier V 32bis/PS/2	No	No	N/A	No	No
	Courier V 32terbo	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier V 32terbo fax	Yes	Yes (BBS)	mdmusrcr inf	No	No
	Courier V 32terbo fax PS/2	No	No	N/A	No	No
	Courier V.Everything with V.34	Yes	Yes (BBS)	mdmusrcr.inf	No	No
	Sportster 14 4 fax V. 42bis	Yes	Yes (BBS)	mdmusrsp inf	No	No
	Sportster 14 4 PCMCIA PC Card	Yes	Yes (BBS)	mdmusrsp.inf	No	No

N/A—Not applicable No INF file is available



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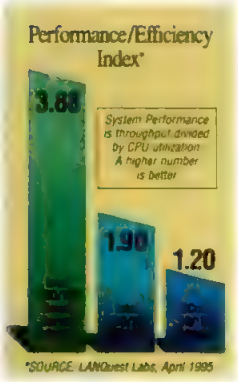

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Designed for Microsoft Windows 95

	Stealth64 Video 3240XL*	Stealth64 Video 3200	Stealth Video 2120XL
Controller:	S3 Vision968	S3 Vision968	S3 Vision868
Vertical Refresh:	To 120Hz	To 120Hz	To 120Hz
Max. Res.:	1600 x 1200	1600 x 1200	[illegible]
Memory:	2MB (up to 4MB) VRAM	2MB VRAM	[illegible] (up to 2MB) DRAM

[illegible] 4MB [illegible]
*Formerly known as Stealth64 Video VRAM

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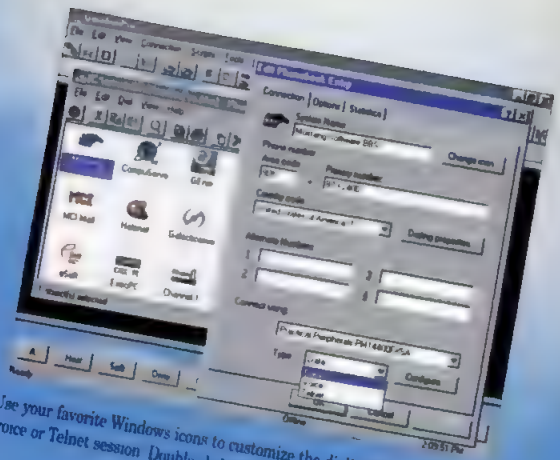
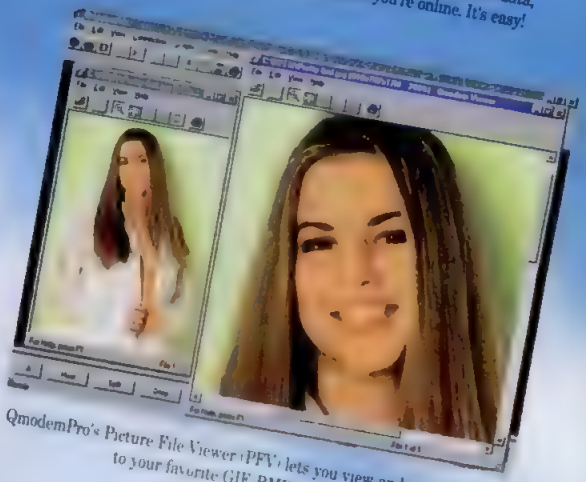
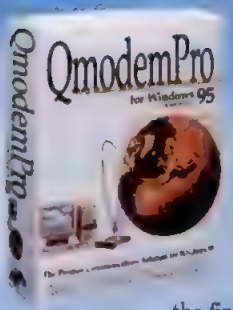
Don't Start Your Modem Without The 32-bit Power Of QmodemPro For Windows 95



Use your favorite Windows icons to customize the dialing directory for data, voice or Telnet session. Double click and in seconds you're online. It's easy!



QmodemPro's Picture File Viewer (PFV) lets you view and zoom in close to your favorite GIF, BMP or JPEG file.



You're a speed freak, right? You bought the Pentium and 28.8 modem, and you just upgraded to Windows® 95 to take full advantage of your computer's 32-bit architecture. So why are you using old 16-bit communication software that chokes the performance of Windows 95? Get on-line fast with the 32-bit POWER in QmodemPro for Windows 95 v2. It's the first communication software that delivers all the features and performance you need to get the most from the new 32-bit Windows platform. And since you demand performance, you'll like the fact that QmodemPro's communication and Internet capabilities go way beyond the standard terminal software included with Windows 95. So whether you're connected to the office, company mainframe or BBS for data/file transfer, you'll get the powerful, 32-bit technology in QmodemPro to satisfy your "need for speed."

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* RSA Data Security, Inc. MD5 Message-Digest Algorithm

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CIRCLE 058 ON READER SERVICE CARD

Modems *Ends*

Company	Product name	.INF file bundled with Win 95	.INF file on-line	.INF filename	Uses Windows NT 3.5 native communication APIs	Uses OS/2 Warp native communication APIs
	Sportster 14.4 V.42bis	Yes	Yes (BBS)	mdmusrsp.inf	No	No
	Sportster 28.8 V.34 fax	Yes	Yes (BBS)	mdmusrsp.inf	No	No
	Sportster 28.8 V.34 PCMCIA PC Card	Yes	Yes (BBS)	mdmusrsp.inf	No	No
	Sportster 9600 fax V.42bis	Yes	Yes (BBS)	mdmusrsp.inf	No	No
	Sportster 9600 V.42bis	Yes	Yes (BBS)	mdmusrsp.inf	No	No
	Sportster Vi 14.4	No	Yes (BBS)	mdmusrvi.inf	No	No
	Sportster Vi 28.8	No	Yes (BBS)	mdmusrvi.inf	No	No
	Sportster Vi 28.8 with DSVD	No	Yes (BBS)	mdmusrvi.inf	No	No
	WorldPort 14.4 V.42bis	Yes	Yes (BBS)	mdmusrwp.inf	No	No
	WorldPort 14.4 V.42bis fax	Yes	Yes (BBS)	mdmusrwp.inf	No	No
	WorldPort 9600 V.42bis	Yes	Yes (BBS)	mdmusrwp.inf	No	No
	WorldPort 9696 V.42bis fax	Yes	Yes (BBS)	mdmusrwp.inf	No	No
	WorldPort Linux Standard Cellular for PCMCIA	No	No	N/A	No	No
	WorldPort Palmtop fax	No	No	N/A	No	No
	WorldPort PCMCIA 14.4 fax	Yes	Yes (BBS)	mdmusrwp.inf	No	No
Zoltrix Inc. Phone, 510-657-1188 fax, 510-657-1280, BBS, 510-657-7413	FM144ATE	Yes	No	See Win 95's modem list	No	No
	FM144ATF	Yes	No	See Win 95's modem list	No	No
	FM144ATI	Yes	No	See Win 95's modem list	No	No
	FM144	No	No	N/A	Yes	Yes
	FM149624	No	No	N/A	No	No
	FM9648	No	No	N/A	No	No
	FM288SE (V.34)	Yes	No	See Win 95's modem list	Yes	Yes
	FM288SE (V.34)	Yes	No	See Win 95's modem list	Yes	Yes
	FM PCM144	No	No	N/A	Yes	Yes
	FM voc144kit	No	No	N/A	No	No
	FM voc149624	No	No	N/A	No	No

N/A—Not applicable. No .INF file is available.

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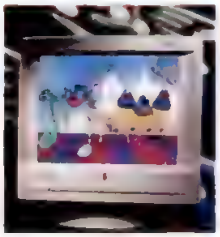

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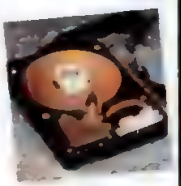

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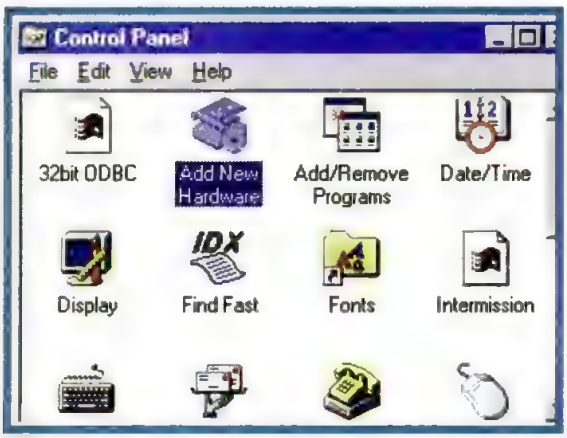
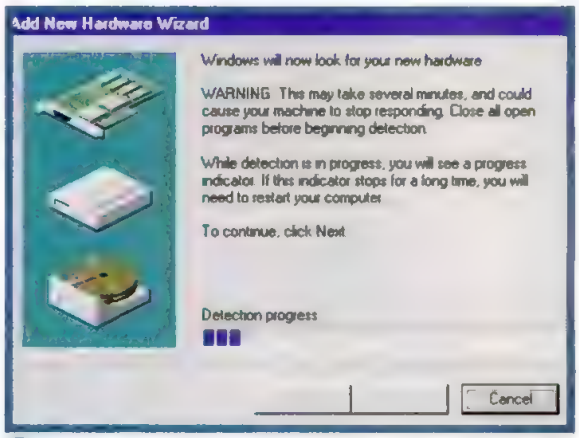
CIRCLE 223 ON READER SERVICE CARD

CD-ROM Drives



1 Windows 95 guides you through the process of adding new hardware. Begin by selecting the Add New Hardware icon under the Windows control panel, which resides under the My Computer icon found in the upper-left-hand corner of your screen.



2 This launches the new Add New Hardware wizard. The first screen searches for the new hardware (SCSI card, CD-ROM, and so on), which you should have installed before booting your computer.

Windows 95 introduces a 32-bit protected-mode CD-ROM file system (CDFS). Like the 16-bit Real-mode counterpart found in Windows 3.*x*, Microsoft CD-ROM Extensions (MSCDEX), CDFS is ISO 9660–compatible. It's much faster, however.

If you already have a CD-ROM drive installed, the Windows 95 installation program checks your AUTOEXEC.BAT for the presence of the MSCDEX driver and automatically installs the 32-bit CDFS driver. Under Windows 95, MSCDEX is no longer necessary.

Unlike its predecessor, CDFS does not use any conventional memory. The CDFS driver also works in tandem with the Windows 95 file system, VFAT. It shares the same cache memory pool, which is dynamically allocated by VCACHE, the 32-bit protected-mode SmartDrive replacement. This contrasts with SmartDrive, which required users to designate the exact amount of memory that would be dedicated to the cache. All of these changes should result in far better multimedia performance on your PC.

3 If the wizard successfully detects and configures your new hardware (it should do so if the add-in is Plug and Play–compatible), then you follow the instructions on this screen and reboot your computer.

Using a CD-ROM drive will be a much smoother experience under Windows 95, with less system lag time and jerkiness when accessing data or when multitasking in another application (say, while you are conducting a complicated search on a CD-ROM drive).—*JM*

THE DRIVER MANUAL

CD-ROM Drives

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
Aztech Labs Inc. Phone, 510-623-8988; fax, 510-623-8989; BBS, 510-623-8933; Internet, *support@aztechca.com*; Web site, *http://www.aztechca.com*	CDA268-01A	Ver. 1.33	Yes No	Yes	N/A	No Yes (BBS)	Ver. 1.02	Ver. 1.10
	CDA268-01A Zeta	Ver. 1.33	Yes No	Yes	N/A	No Yes (BBS)	Ver. 1.02	Ver. 1.10
	CDA268-03I	Ver. 2.10	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	CDA268-03I SE	Ver. 2.10	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
Chinon America Inc. Phone, 310-533-0274; fax, 310-533-1727; BBS, 310-320-4160	CDA-535	CDINIT	No No	Yes	N/A	No Yes (BBS)	Not named	None
	CDS-525S	NCS 6.0 for NCS SCSI card	No No	Yes	N/A	No Yes (BBS)	Not named	None
	CDS-535	CDRVR SYS	No No	Yes	N/A	No Yes (BBS)	Not named	None

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.

CD-ROM Drives

Continues

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	CDS 545	CH[illegible]DF.SYS	No No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	[illegible]DX 535	[illegible]R.SYS	No No	Yes	N/A	No Yes (BBS)	Windows NT driver	None
Computer Connections Phone 800 [illegible] 5336 fax 617 [illegible] BBS 617 275 [illegible] CompuServe 76015,2670	CD Shuttle P	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CD Shuttle PS	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CD Shuttle PSM	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CDS 3X P	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CDS 3X PS	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CDS 4X PS	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
	CDS 6X PS	Not named	No Yes	No	8/95	No Yes (BBS)	None	OS/2 Add driver
Fidelity International Technologies Phone 901 417 2130 fax 901 [illegible] BBS 901 417 [illegible] CompuServe 76470,604	TransCD TCD4X P (Double Speed)	TC[illegible]DF.SYS Ver 5.00A	Yes No	Yes	N/A	No Yes (BBS)	None	None
	TransCD TCD4X P (Quad Speed)	TCD[illegible]DF.SYS Ver 5.00A	Yes No	Yes	N/A	No Yes (BBS)	None	None
LG Electronics (GoldStar Technologies Inc.) Phone 201 816 2700 fax 201 816 0636	Goldstar GCD-R320B	FDCD.SYS Ver 2.4	No No	No	None	No No	None	None
	Goldstar GCD-R420B	GCD-420.SYS Ver 1.34	No No	No	None	No No	None	None
	Goldstar GCD-R520B	GCD-R520.SYS Ver 2.14	Yes No	Yes	None	Yes No	Supported by OS	IBMIDECD.FLT
	Goldstar GCD-R540B	GSLCDR04.SYS Ver 2.14	Yes No	Yes	N/A	Yes No	Supported by OS	IBMIDECD.FLT
Liberty Systems Inc. Phone 800 [illegible] fax 408 [illegible] BBS 408 243 [illegible]	115 Series CD4xP	EPSA2 ASPICD.SYS	Yes No	Yes	N/A	Yes Yes (BBS)	EPSA2WNT	EPSAOS/2
	115 Series CD4xTP	EPSA2 ASPICD.SYS	Yes No	Yes	N/A	Yes Yes (BBS)	EPSA2WNT	EPSAOS/2
	115 Series CDP	EPSA2 ASPICD.SYS	Yes No	Yes	N/A	No Yes (BBS)	EPSA2WNT	EPSAOS/2
Media Vision Inc. Phone 510 [illegible] 8600 fax 510 [illegible] BBS 510 770 [illegible] CompuServe GO MEDIAVI SIGN Internet TechSupp@MediaVis.com Web site, http://www.mediavis.com	NEC 55JD	TSLCDR.SYS Ver 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	NEC 83J	TSLCDR.SYS Ver 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	NEC 84	TSLCDR.SYS Ver 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	NEC 84JD	TSLCDR.SYS Ver 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	NEC 210	TSLCDR.SYS, Ver. 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	NEC 510	TSLCDR.SYS, Ver. 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Philips 205	DD260.sys, Ver. 1.31	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Philips 206	DD260.sys, Ver. 1.31	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Optical Storage 8322	SRAY.SYS, Ver. 1.05	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Reno Portable CD-ROM Player	TSLCDR.SYS, Ver. 3.18	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sanyo CDR 254S	Mini406a.sys, Ver. 3.0	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sanyo H-93MV	SLCD.SYS, Ver. 1.73a	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sanyo H-94AMV	SJCD.SYS, Ver. 1.00	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sanyo H-94SMV	SLCD.SYS, Ver. 1.73a	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sony 31A	SLCD.SYS, Ver. 1.73a	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Sony 33A	SLCD.SYS, Ver. 1.73a	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
	Toshiba XM 5302B	FDATACD.SYS, Ver 2.12	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	None
Micro Solutions Inc. Phone 800 [illegible] 7227 fax 815 756 [illegible] BBS 815 756 9100	Backpack 2X CD-ROM	BP[illegible]DRV.SYS Ver [illegible]	No Yes	Yes	N/A	No Yes (BBS)	None	BPCDROM.ADD Ver [illegible]
	Backpack 2X CD-ROM with sound	Not yet released	Yes No	No	7/95	No Yes (BBS)	None	None
	Backpack 4X CD-ROM	BPCDDRV.SYS, Ver 2.01	No Yes	Yes	N/A	No Yes (BBS)	None	BPCDROM.ADD, Ver 2.01
	Backpack 4X CD-ROM with sound	Not yet released	Yes No	No	7/95	No Yes (BBS)	None	None
Micro Design International Inc. Phone [illegible] fax [illegible]	LaserBank CD[illegible]	SCSI Express for [illegible] Ver [illegible]	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver [illegible]
	LaserBank CD0CDX	SCSI Express for [illegible] Ver [illegible]	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver [illegible]

N/A = Not applicable. Yes/No = Yes = Driver is Win 95–compatible. Yes = Supplied by vendor. Yes/No = Yes = Driver support built into the operating system.

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PC MAGAZINE CIRCLE 371 ON READER SERVICE CARD

Start

Started Months Ago

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CIRCLE 233 ON READER SERVICE CARD

CD-ROM Drives

Continues

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95-compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	SCSI Express 36CD	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	SCSI Express 53CD	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	SCSI Express 600CD4X	SCSI Express for DOS Ver. 2.2.3	Yes No	No	4th quarter 1995	No No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	SCSI Express 600CDL	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	SCSI Express 600CDX	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	SCSI Express Tower	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
	Extender Option	SCSI Express for DOS Ver. 2.2.3	Yes No	Yes	N/A	Yes No	Supported by OS	SCSI Express OS/2 Ver. 3.1.2
Mitsumi Electronics Corp. Phone 408 642 7864 fax 714 [illegible] 7306 BBS 408 970 0700	CRMC FX001D	Ver. 1.23 DOS	Yes No	No	None	Yes No	Ver. 1.0	Supported by OS
	CRMC FX001DE	Ver. 1.34 DOS	Yes Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CRMC FX400	Ver. 1.34 DOS	Yes Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CRMC FX400B	Ver. 1.34 DOS	Yes Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CRMC FX400D	Ver. 1.34 DOS	Yes Yes	Yes	N/A	Yes No	Supported by OS	Supported by OS
NEC Technologies Phone 800 632 4636 fax 800 366 4406 BBS [illegible] 4708 America Online NECTECH Internet tech.support@nectech.com Website http://www.nec.com	CDR38	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 3Xe	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 3Xi	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 3Xp	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 3Xp Plus	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 4X Pro	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 4Xe	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 4Xi	Ver. 2.0	Yes No	No	None	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 6Xe	Ver. 2.0	Yes No	Yes	N/A	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
	MultiSpin 6Xi	Ver. 2.0	Yes No	Yes	N/A	Yes No	T160.SYS 6/14/94	T160SCSI.ADD 6/15/94
Pioneer New Media Technologies Inc. Phone 800 444 6784 fax 310 952 2309 BBS 310 835 7980	DR-U124x	Via third party	No No	No	None	Yes No	Supported by OS	None
	DRM-602X	Via third party	No No	No	None	Yes No	Supported by OS	Supported by OS
	DRM-604X	Via third party	No No	No	None	Yes No	Supported by OS	Supported by OS
	DRM-624X	Via third party	No No	No	None	Yes No	Supported by OS	None
	DRM-804x	Via third party	No No	No	None	No No	None	None
	DRM-5004X	Via third party	No No	No	None	No No	None	None
Plexor Phone 800 886 3935 fax 408 [illegible] 7510 BBS 408 986 1569 CompuServe GO CDROM Internet support@plextor.com	DM-3020	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-3021	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-3024	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-3028 "Double-Speed Plus"	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-5020	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-5021	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-5024	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	DM-5028 "Double-Speed Plus"	Trantor TSLCDR.SYS Ver. 3.07	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	PX-43CH "4PLeX"	Future Domain FDCD.SYS, Ver. 4.03 PLEXTOR.SYS, Ver. 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	PX-43CS "4PLeX 256"	Future Domain FDCD.SYS, Ver. 4.03 PLEXTOR.SYS, Ver. 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS
	PX-45CH "4PLeX"	Future Domain FDCD.SYS, Ver. 4.03, PLEXTOR.SYS, Ver. 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP, CIS, Web)	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.

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The easiest, most reliable way to protect and manage your PC's most valuable component... Your Data.

Protecting critical files is important, but it's not the only reason for buying a tape system. Move large files from home to office. Store important old records on tape. Use it to free up disk space. Once you think about tape as a data management system, it's easy to justify an *affordable** HP Colorado T1000.

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MAVERICK IDE & SCSI-2 SERIES

270MB	IDE	30270MVA	14ms	$145
540MB	IDE	30540MVA	14ms	$172
540MB	SCSI	30540MVS	14ms	$179

LIGHTNING IDE & SCSI-2 SERIES

365MB	IDE	30365LTA	11ms	$152
730MB	IDE	30730LTA	11ms	$199
365MB	SCSI	30365LTS	11ms	$119
540MB	SCSI	30540LTS	11ms	$184
730MB	SCSI	30730LTS	11ms	$235

TRAIL BLAZER SERIES

420MB	30420TRA	12ms	ATA-2	$149..$259
840MB	30850TRA	12ms	ATA-2	$219..$329
420MB	30420TRS	12ms	F.SCSI-2	$172..$259
840MB	30850TRS	12ms	F.SCSI-2	$258..$349

FIREBALL SERIES

540MB	30540FBA	12ms	ATA-2	$179..$289
1.08GB	31080FBA	12ms	ATA-2	$264..$274
540MB	30540FBS	12ms	F.SCSI-2	$185..$275
1.08GB	31080FBS	12ms	F.SCSI-2	$375..$465

EMPIRE FAST SCSI-2 SERIES

2.1GB	EMP21000S	8.0ms	$769..$859

CAPELLA FAST SCSI-2 SERIES

2.2GB	VP32210S	8.5ms	3.5"x1"	$789..$889

ATLAS FAST SCSI-2 SERIES

2.1GB	XP32150S	8ms	7200RPM	$889...$979
4.3GB	XP34300S	8ms	7200RPM	$1489.$1579

GRAND PRIX SCSI-2 SERIES

4.3GB	GP34301S	8.6ms	7200RPM	$1088..$1178

Maxtor

IDE & ENHANCED IDE DRIVES

420MB	7420AV	12ms	IDE	$145
540MB	7540AV	12ms	IDE	$175
850MB	7850AV	12ms	E-IDE	$225
1.2GB	71260AV	<12ms	E-IDE	$319

CONNER

IDE & ENHANCED IDE DRIVES

420MB	CFS420A	14ms	IDE	$149
540MB	CFS540A	<15ms	IDE	$175
540MB	CFA540A	12ms	E-IDE	$199
850MB	CFS850A	<15ms	E-IDE	$225
1.27GB	CFS1275A	<15ms	E-IDE	$295

FAST SCSI-2 SERIES

1.0GB	CFP1060S	9ms	3.5"x1"	$439..$539
1.0GB	CFP1080S	*NEW*	3.5"x1"	$399..$489
2.1GB	CFP2105S	<9ms	5400RPM	$819..$899
2.1GB	CFP2107S	<9ms	7200RPM	$899..$989
4.2GB	CFP4207S	<9ms	7200RPM	$1269.$1359

WESTERN DIGITAL

ENHANCED IDE DRIVES

540MB	WDAC2540	12ms	3.5"x1"	$205
850MB	WDAC2850	<10ms	3.5"x1"	$225
1.0GB	WDAC31000	<10ms	3.5"x1"	$308
1.2GB	WDAC31200	<10ms	3.5"x1"	$319
1.6GB	WDAC31600	<10ms	*NEW*	$599

FUJITSU

IDE & FAST SCSI-2 SERIES

530MB	M2684TAU	12ms	IDE	$179..$289
530MB	M2684SAU	12ms	SCSI	$195..$288
1.0GB	M1606SAU	10ms	SCSI	$415..$509

IBM

1.0GB	DPEA-31080	10.5ms	IDE	$359..$469
1.0GB	DPES-31080	10.5ms	SCSI	$469..$559
4.3GB	94G3057	8.5ms	SCSI	$699 $799
5.0GB	94G3787	*NEW*	SCSI	$899 $989

HARD DRIVES

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FAST SCSI-2 DRIVES

1.75GB	MC2217	10ms	3.5"	$789	...$889
2.0GB	MC4221	8.5ms	3.5"x1"	$979	..$1079
3.0GB	MC1936	13ms	5.25"	$639	...$829
4.0GB	MC3243	8.5ms	3.5"	$1549	..$1649
9.1GB	MC1991	11ms	5.25"	$2099	..$2279

Audio Video FAST SCSI-2 DRIVES

1.75GB	MC2217AV	10ms	3.5"	$819	...$889
2.0GB	MC3221AV	8.5ms	3.5"	$1039	...$1129
2.0GB	MC4221AV	8.5ms	3.5"x1"	$1099	..$1199
4.0GB	MC3243AV	8.5ms	3.5"	$1699	..$1799
9.1GB	MC1991AV	11ms	5.25"	$2189	..$2369

Seagate

FAST SCSI-2 SERIES

1.0GB	ST31230N	10ms	3.5"x1"	$529	...$619
1.0GB	ST31200N	9ms	3.5"x1"	$535	...$625
2.1GB	ST32430N	10ms	3.5"x1"	$889	..$979
2.1GB	ST32550N	8ms	3.5"x1"	$1039	..$1129
4.3GB	ST15150N	8ms	3.5"	$1439	.$1529
4.3GB	ST15230N	9ms	3.5"	$1099	..$1189
9.0GB	ST410800N	11.5ms	5.25"	$2299	.$2499

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FUJITSU

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REMOVABLE CARTRIDGE DRIVES

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200MB	SQ5200C	Int/(Ext w/cart) $359/$499
200MB	SQ6200C	Mac Ext w/cart &SW $519
270MB	SQ3270A	IDE for PCs $331
270MB	SQ3270S	Int/(Ext w/cart) $339/$469
270MB	SQ3270S	Mac Ext w/cart &SW $489
270MB	SQ3270P	Ext for Parallel w/cart $569

2.5" DRIVES

TOSHIBA

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540MB	MK1924FCV	12.7mm	ATA-2	$399
704MB	MK2528FC	19mm	ATA-2	$499
810MB	MK2628FC	19mm	ATA-2	$559
1.0GB	MK2720FC	19mm	ATA-2	$729

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EXB4200C 4GB-Up to 28MB/min	$799/$899
8205XL 3.5 to 7GB-Up to 32MB/min	$1275/$1569
8505XL 7 to 14GB-Up to 60MB/min	$1999/$2299
EXB-8IKT 5.25" Bracket for 3.5" Units	$29

HEWLETT PACKARD

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35480A 4-8GB, Up to 44MB/min	$859/$949
1533A 4-8GB,H/W Comp. DDS2	$1019/$1119
1553A 24-48GB,6 Cart AutoLoader	$2199/$2369
HP-BIKT 5.25" Bracket for 3.5" Units	$39

CONNER

TapeStor Series

TS420 420MB-Floppy Based	$169
TS420P 420MB-Parallel Port Backup	$298
TS800 800MB-TRAVAN Technology	$209
TS800P 800MB-Parallel Port TRAVAN	$369
TS850 850MB-QIC Wide-Floppy Based	$259
TS850P 850MB-Parallel Port Backup	$349
TS1700 1.7GB-QIC Wide-W/Floppy Cont	$305
TS4000A 4.0GB-QIC Wide-IDE w/cord	$520
TS4000 4.0GB-QIC Wide-SCSI Based	$519
TS4000E4.0GB-QIC Wide-SCSI External	$619

COLORADO MEMORY SYSTEMS

Floppy Based Backup Units

DJ35 350MB-JUMBO 350	$142
DJ25 680MB-JUMBO 700	$258
T1000 800MB-HP Colorado T-1000	$195
DJ50 1.4GB -JUMBO 1400 *NEW*	$299

TRAKKER Parallel Backup Units

JT35 350MB-TRAKKER 350	$329
JT25 680MB-TRAKKER 700	$349

WangDAT

4mm DAT SCSI Backup Units

3100 2.0GB-3.5"-DDS-Up to 11M/min	$735/$829
3200 4-8GB,DDS-DC,Up to 22M/min	$789/$989
3400DX 4-8GB,DDS-2, 22-44MB/min	$989/$1089

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PINNACLE MICRO RECORDERS

RCD-1000 Pinnacle 2X Ext Unit	$1629
RCD-1000 Pinnacle 2X- w/Cont	$1739

SMART & FRIENDLY RECORDERS

CD-R1002 2X w/Cont & Corel	$1659
CD-R4000 4X w/Cont & Corel	$3569

CONTROLLERS

PROMISE

IDE & SCSI Hi-Performance Controllers

2300+	32-Bit VLB 2-IDE/2F, 2-165505er,Ext BIOS	$69
4030+	Same as above,w/up to 16MB Cache	$129
EIDE-MAX	16-BIT ISA Co-Exist w/BIOS,up to 8GB Sup	$29
DC400	32-Bit VLB BusMaster SCSI/IDE w/IO	$186
6030	32-Bit PCI BusMaster IDE Caching	$136

HDSS IDE CONTROLLERS

200	16-Bit ISA 2HD/2FD w/cables	$12
211	16-Bit ISA 2HD/2FD -2Ser/1Prl/1Gm	$19
400	16-Bit ISA 2H/2F, 2-165505er/1P/1G	$29
500	32-Bit VLB 2-EIDE/2F, 2-165505er/1EPP/1G	$39
600	32-Bit PCI 4-EIDE/2F, 2-165505er/1EPP/1G	$49

BUSLOGIC IDE Caching Controllers

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KT510A	16-Bit ISA Up to 5mb/sec	$89
KT910A	32-Bit PCI Up to 20mb/sec	$168

OPTICALS

Maxoptix

Tahiti-4M	1MB Cache Buffer	$1779/$1869
Tahiti-3M	1MB Cache Buffer	$1819/$1999
Tahiti-3M	4MB Cache Buffer	$1999/$2199
1.3GB Cart(512 or 1024b)Glass/Poly		$135/$99

FUJITSU

DynaMO 2512A 230MB 3.5" Optical

Internal 230MB Unit	$535
External w/Cart for PC	$669
External w/Cart & S/W for MAC	$685
External Complete KIT for PC	$777

PINNACLE MICRO

TAHOE 230MB

Tahoe230 MAC	Portable 230 for Mac	$739
Tahoe230 PCT	Portable 230 for PC/Parallel	$919
Tahoe230 PCA	Portable w/ 16Bit Adapter Kit	$919
Tahoe230 PCAN	Portable 230 Unit Only	$729

Sierra 1.3GB

Sierra1.3 MAC	Ext 1.3GB for Mac	$1769
Sierra1.3PC	Ext 1.3GB for PC w/ Adapter	$1899
Sierra1.3 PCI	Int for PC w/16Bit Adapter	$1879
Sierra1.3PCAN	Ext 1.3GB for PC	$1759

CD ROM DRIVES

PIONEER

The Art of Entertainment

DRU-124X	1 DISC-4.4X *NEW*	$269/$59
DRM-624X	6 CD-4.4X **NEW**	$549
DRM-A600	6 DISC Magazine	$25

TOSHIBA

		INT / EXT
XM3601B	4.4X-120ms-600kb	$339/$429
XM5302B	4.4X-120ms-600kb IDE	$199/$309

PLEXTOR

NEW 6X

43CS/6CS	4X-256K Cache-600kb INT/EXT	$329/409
43CH/6CH	4X-1MB Cache INT/EXT	$399/489
63CH/6CH	6X-256K Cache-600kb INT/EXT	$499/589

SCSI CONTROLLERS

adaptec

1460	Slim SCSI PCMCIA Kit *NEW*	$98
1505	16-Bit ISA Total CD SCSI2	$64
1522K	16-Bit ISA SCSI-2(7-Dev)+2FD Kit	$136
1542P	16-Bit BusMaster Fast SCSI-2 KIT	$239
1640K	MicroChannel PS/2 KIT/Card	$295/189
2742T	32-Bit Twin-EISA 14 Devices, KIT	$348
2742W	32-Bit Wide EISA w/Wide Cable KIT	$378
2825VL	32-Bit VLB E-IDE/SCSI-2 KIT	$154
2842A	32-Bit VLB Fast SCSI-2 KIT	$229
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CIRCLE 267 ON READER SERVICE CARD

CD-ROM Drives

Continues

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	PX-45CS, "4PLeX 256"	Future Domain FDCD.SYS, Ver 4.03, PLEXTOR SYS, Ver 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP CIS, Web)	Supported by OS	Supported by OS
	PX-63CS, "6PLeX"	Plextor PLEXTOR.SYS, Ver 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP CIS, Web)	Supported by OS	Supported by OS
	PX-65CS, "6PLeX"	Plextor PLEXTOR.SYS, Ver 1.0	Yes No	Yes	N/A	No Yes (BBS, FTP CIS, Web)	Supported by OS	Supported by OS
Reveal Computer Products Inc. Phone 800-473-8325 fax 818-346-2379 BBS, 818-713-8188, CompuServe, GO REVEAL; Prodigy, Reveal, Web site, *http://www.Reveal.com*	Reveal 520	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS Prodigy, Web)	None	Supported by OS
	Reveal 540	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS Prodigy, Web)	None	Supported by OS
	Funai E2420EU	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	None
	Mitsumi CRMC FX400B	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS Prodigy, Web)	None	Supported by OS
	NEC 272	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
	Panasonic 523-B (external)	Not named	No No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
	Panasonic 523-B (internal)	Not named	No No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
	Panasonic 563	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
	Panasonic 563-B	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
	Sony CDU33A-01	Not named	Yes No	No	3rd quarter 1995	No Yes (BBS, CIS, Prodigy, Web)	None	Supported by OS
Sony Electronics Inc. Phone 800-326-9551, BBS 408-955-5107	CDU-31A-02	SLCD.SYS, Ver 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	SLCD32.SYS Ver 1.00	SONY31 ADD
	CDU-31A-LL/N (Desktop Library 1X)	SLCD.SYS Ver 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	None	SONY31 ADD
	CDU-31A-LL/N (Desktop Library 1X)	SLCD.SYS, Ver 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	SLCD32.SYS Ver 1.00	SONY31 ADD
	CDU-33A-01	SLCD.SYS, Ver. 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	SLCD32.SYS, Ver 1.00	SONY31 ADD
	CDU-33A-01/10	SLCD.SYS, Ver 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	SLCD32.SYS Ver 1.00	SONY31 ADD
	CDU-33A/L (Desktop Library 2X)	SLCD.SYS, Ver 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	None	SONY31 ADD
	CDU-33A/N (Desktop Library 2X)	SLCD.SYS, Ver. 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	SLCD32.SYS, Ver 1.00	SONY31 ADD
	CDU-55E-01 (ATAPI)	ATAPI_CD.SYS, Ver 2.22A	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-55E-01/10	ATAPI_CD.SYS, Ver. 2.22A	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-55S-01 (SCSI)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-55S-01/10	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-535-01	SONY_CDU.SYS, Ver 2.20X	No No	No	None	No No	None	SONY535 ADD
	CDU-535-01P Bundle	SONY_CDU.SYS, Ver 2.20X	No No	No	None	No No	None	SONY535 ADD
	CDU-541-01 (SCSI)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-561-01 (SCSI)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-561-10 (SCSI)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-6811-10 (SCSI)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-7205/N	SONY_CDU.SYS, Ver 2.20X	No No	No	None	No No	None	SONY535 ADD
	CDU-7211W (SCSI)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-7305 (Desktop Library 1X)	SLCD.SYS, Ver. 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	None	SONY31 ADD
	CDU-7305-3A (Desktop Library 2X)	SLCD.SYS, Ver. 1.73A	Yes No	Yes	N/A	Yes Yes (BBS)	None	SONY31 ADD
	CDU-7511UC2 (SCSI)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CDU-7811-10 (SCSI)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CSD-76SB (SCSI)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CSD-760E (ATAPI Bundle)	ATAPI_CD.SYS, Ver. 2.22A	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CSD-760S (SCSI Bundle)	ASPICD.SYS, Ver 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.

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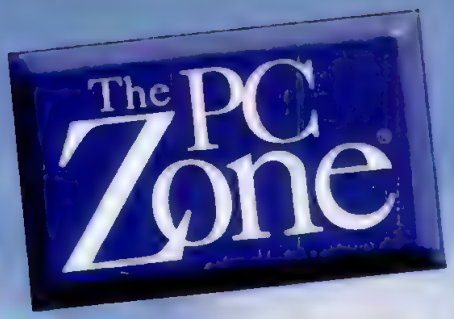

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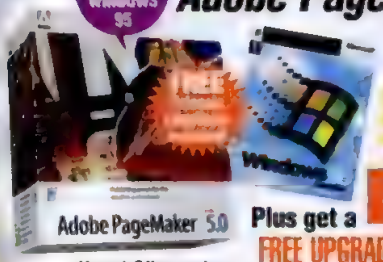

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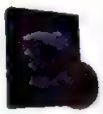

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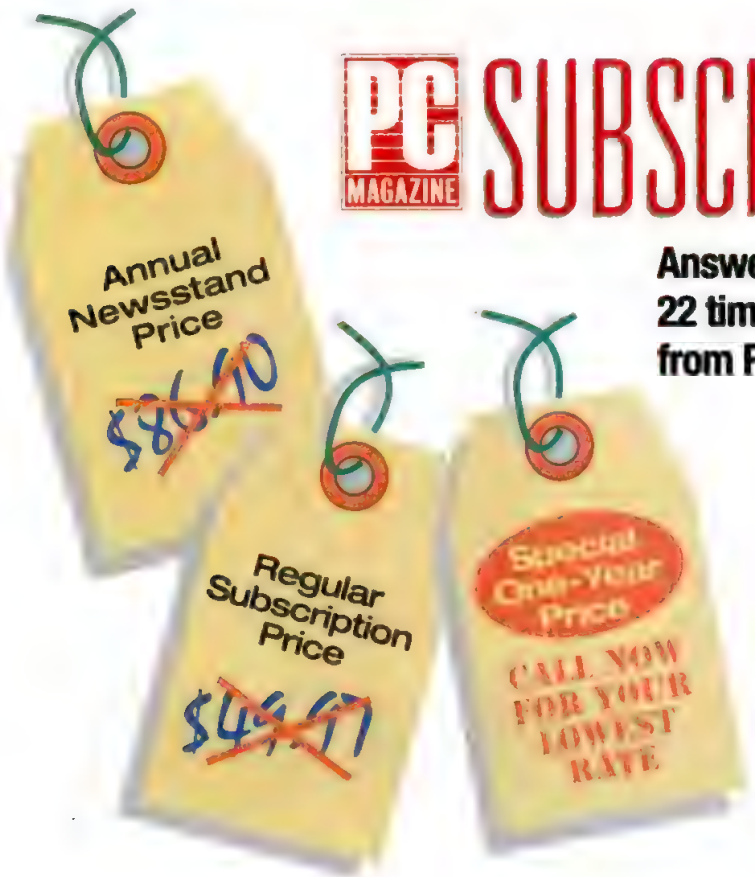
CD-ROM Drives

Ends

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	CSD 7611M (SCSI Bundle)	ASPI CD SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CSP-920S (Spressa, Rec./Play)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	CSP-9211S (Spressa, Rec./Play)	ASPICD.SYS, Ver. 3.11L	Yes No	Yes	N/A	Yes No	Supported by OS	Supported by OS
	PRD-150 (CD-ROM Discman)	PRD150.SYS, Ver. 1.1	Yes No	No	None	No No	None	None
	PRD-155SB (CD-ROM Discman)	PRD150.SYS, Ver. 1.1	Yes No	No	8/95	No No	None	None
Toshiba America Information Systems Inc. Phone 714 457 0777 fax 714 583 3133 BBS 714 837 8664	XM-1102B (internal)	Future Domain, Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	XM-3601B (internal)	Future Domain Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	XM-3601D (external)	Future Domain Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	XM-5301B (internal)	Future Domain Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	XM-5301D (external)	Future Domain Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	XM-5302B (internal)	Future Domain Ver. 2.5.1	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Wearnes CDD-110	CDD.SYS, Ver. 1.6	Yes No	Yes	N/A	No Yes (BBS)	None	CDD110.ADD, Ver 0.31
Wearnes Peripherals Corp. Phone 408 432 1888 fax 408 436 1899 BBS 408 432 1884	Wearnes CDD-120	WCD.SYS Ver 2.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Wearnes CDD-120A	WCD.SYS ver 2.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Wearnes CDD-120X	WCD.SYS Ver 2.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.



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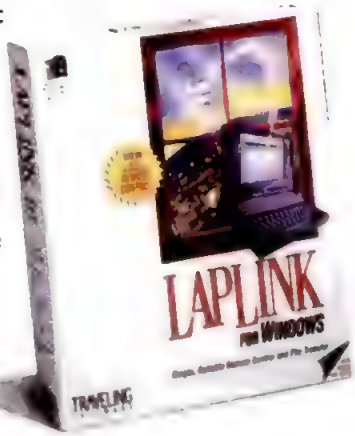

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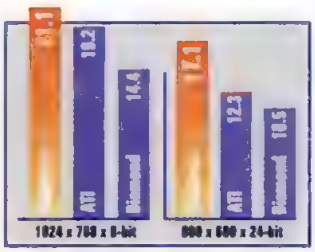

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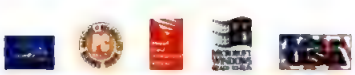

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CIRCLE 215 ON READER SERVICE CARD

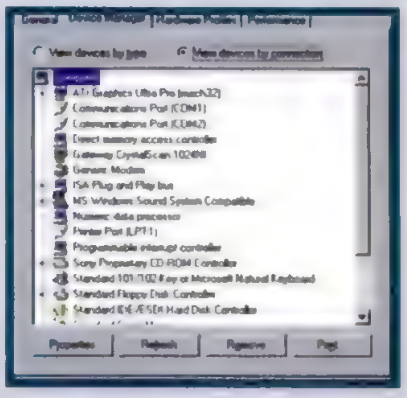
Sound Cards

You should be able to continue using your current 16-bit sound card drivers with Windows 95, much as you will be able to use the other add-in devices discussed here. Windows 95 now includes drivers for a number of popular sound cards, and it will automatically replace your old ones if it has the update.

Windows 95 should automatically detect newer Plug and Play cards during installation. Windows 95 reads your CONFIG.SYS and SYSTEM.INI, scanning for existing sound card driver information. It tries to avoid scanning I/O ports, because that could result in a hung machine. But if the card's drivers are prebundled with the OS, they'll be installed and configured for you.

By the same token, Windows 95 will not erase esoteric drivers that are not included on Windows 95's driver list. Microsoft expects those cards to work without difficulty as well.

Additionally, Windows 95 now includes preemptive multitasking, which should help in handling complex MIDI sound files. Essentially, Windows 95 sends multiple MIDI instructions during a single interrupt.—*LU*



Open the System Properties dialog box by double-clicking on the System icon in the Windows 95 Control Panel. The Device Manager tabs let you view all devices (often by name) and their port connections.

THE DRIVER MANUAL

Sound Cards

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
ACS Computer USA Phone 408 481 9988 fax 408 481 0880 BBS 408 522 2669	LaserWave Nucleus 16	ES 688 WIN DRV, Ver 4 0 ES 688 WIN VXD Ver 4 0 ES 688 WIN DRV Ver 4 15, ES 688 WIN 386 Ver 4 15	Yes Yes	Yes	N/A	Yes Yes (BBS)	None	None
	LWS-16 IDE	ES 688 WIN DRV, Ver 4 0, ES 688 WIN VXD, Ver 4 0 ES 688 WIN DRV Ver 4 15 ES 688 WIN 386 Ver 4 15	Yes Yes	Yes	N/A	Yes Yes (BBS)	None	None
	LWS-16 MCD	ES 688 WIN DRV, Ver 4 0, ES 688 WIN VXD, Ver 4 0, ES 688 WIN DRV Ver 4 15, ES 688 WIN 386, Ver 4 15	Yes Yes	Yes	N/A	Yes Yes (BBS)	None	None
Advanced Gravis Computer Technology Ltd. Phone, 604 431 5020; fax, 604 431 5055, BBS 604 431 5927 America Online, Gravis CompuServe, GO PCVENB Internet, *tech@gravis.com* Web site *http://www.gravis.com*	UltraSound ACE (Audio Card Enhancer)	Windows driver, Ver 5 50	Yes No	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Via third party
	UltraSound MAX	Windows driver, Ver 5 50	Yes No	Yes	N/A	No Yes (BBS, AOL, CIS)	None	Via third party
Antex Electronics Corp. Phone, 800 338 4231, fax 310 532-8509, America Online, *antexsales@aol.com*	SX-3	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX-5e	ANTEXWAV DRV, Ver. 2.0	Yes No	Yes	N/A	No No	ANTEXWAV.DLL, Version 8 0	None
	SX-7	ANTEXWAV DRV,	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX-9	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX-11	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	[illegible]	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX-20	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX 22	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None
	SX-23e	ANTEXWAV DRV, Ver 2 0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8 0	None

N/A Not applicable The current driver is Windows 95-compatible Note "Supported by OS" means driver support is built into the operating system

Sound Cards

Continues

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	SX 26	ANTEXWAV DRV Ver. 2.0	Yes No	Yes	N/A	No No	ANTEXWAV DLL Version 8.0	None
	SX-33	ANTEXWAV.DRV Ver. 2.0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8.0	None
	SX-33e	ANTEXWAV DRV, Ver. 2.0	Yes No	Yes	N/A	No No	ANTEXWAV DLL Version 8.0	None
	Z1e	ANTEXWAV DRV Ver. 2.0	Yes No	Yes	N/A	No No	ANTEXWAV DLL, Version 8.0	None
AVM Technology Inc. Phone 800 880 0041, fax 801 571 3634 CompuServe GO MIDICVEN	Alta 2	Alta DRV Release 3.0	Yes Yes	Yes	N/A	Yes Yes (CIS, Web)	AVMWNET.DRV, Release 1	AVMOS2, Ver. 1.0
	AV Media	AV Media DRV Release 1.0	Yes Yes	Yes	N/A	Yes Yes (CIS Web)	AVMWNET DRV Release 1	AVMOS2 Ver 1.0
Aztech Labs Inc. Phone 510 623 8988, fax 510 623 8989 BBS 510 623 8933 Internet, *support@aztechca.com*; Web site, *http://www.aztecca.com*	Aztech Double-speed CD-ROM Drive	Ver. 1.33	Yes No	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Ver. 1.10
	Aztech Double-speed IDE CD-ROM Drive	Ver. 2.10	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Aztech Explorer Kit	Ver. 1.02	Yes Yes	No	None	No No	None	None
	Aztech Video Galaxy Board	Ver. 1.00	Yes No	Yes	N/A	No No	None	None
	Aztech Video Galaxy Card	Ver. 1.04	Yes Yes	No	None	No No	None	None
	Aztech Video Galaxy Gamma Card	Ver. 1.10	Yes Yes	Yes	N/A	No No	None	None
	Aztech Video Galaxy Oscar Card	Ver. 1.30	Yes No	Yes	N/A	No No	None	None
	Sound Galaxy Asteroid/ Voyager Kit	Ver. 1.07	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy BASIC 16	Ver. 2.07	Yes Yes	No	None	No No	None	None
	Sound Galaxy Business Audio	Ver. 1.5	Yes Yes	No	None	No No	None	None
	Sound Galaxy BX	Ver. 1.5	No No	No	None	No No	None	None
	Sound Galaxy BX II Extra	Ver. 2.31	No Yes	No	None	No No	None	None
	Sound Galaxy BX III	Ver. 1.00	No Yes	No	None	No No	None	None
	Sound Galaxy Double-speed Multimedia Upgrade Kit	Ver. 1.02	Yes Yes	No	None	No No	Ver. 1.00	Ver. 1.00
	Sound Galaxy FM Radio Card	Ver. 1.12	No No	Yes	N/A	No No	None	None
	Sound Galaxy FM Radio Extention board	Ver. 1.00	No No	Yes	N/A	No No	None	None
	Sound Galaxy NOVA 16	Ver. 1.00	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy NOVA 16 Extra	Ver. 1.01	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy NOVA 16 Extra II	Ver. 2.01	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.00	Ver. 1.00
	Sound Galaxy NX	Ver. 1.5	No No	No	None	No No	None	None
	Sound Galaxy NX II	Ver. 2.11	No Yes	No	None	No No	None	None
	Sound Galaxy NX II Extra	Ver. 2.31	No Yes	No	None	No No	None	None
	Sound Galaxy NX PRO (A)	Ver. 2.11	No Yes	No	None	No No	None	None
	Sound Galaxy NX PRO (M)	Ver. 2.11	No Yes	No	None	No No	None	None
	Sound Galaxy NX PRO Extra	Ver. 2.22	No Yes	No	None	No No	None	None
	Sound Galaxy NX PRO 16	Ver. 1.62	Yes Yes	No	None	No No	None	None
	Sound Galaxy Orion 16	Ver. 1.00	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy PRO 16	Ver. 2.07	Yes Yes	No	None	No No	None	None
	Sound Galaxy PRO 16 Extra	Ver. 1.03	Yes Yes	No	None	No No	Ver. 1.00	Ver. 1.00
	Sound Galaxy Stellar Kit (Clinton 16W)	Ver. 2.02	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy Stellar Kit (Clinton G)	Ver. 2.02	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.02	Supported by OS
	Sound Galaxy Wavender 32 Plus	Ver. 2.02	Yes Yes	Yes	N/A	Yes Yes (BBS)	Ver. 1.00	Ver. 1.00
	Sound Galaxy Wavetide Card	Ver. 1.00	No No	No	None	No No	None	None
Creative Labs Inc. Phone, 408-428-6600, fax, 408-428-6611; BBS, 405-742-6600; CompuServe, GO BLASTER; Web site, *http://www.creaf.com*	Sound Blaster 16 Value Edition	SB16AUX DRV Ver. 2.10, SB16FM DRV, Ver. 1.51, SB16SND DRV, Ver. 3.04	Yes Yes	Yes	N/A	Yes No	SNDBLST.SYS	SB16D2.SYS Ver. 2.36

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.

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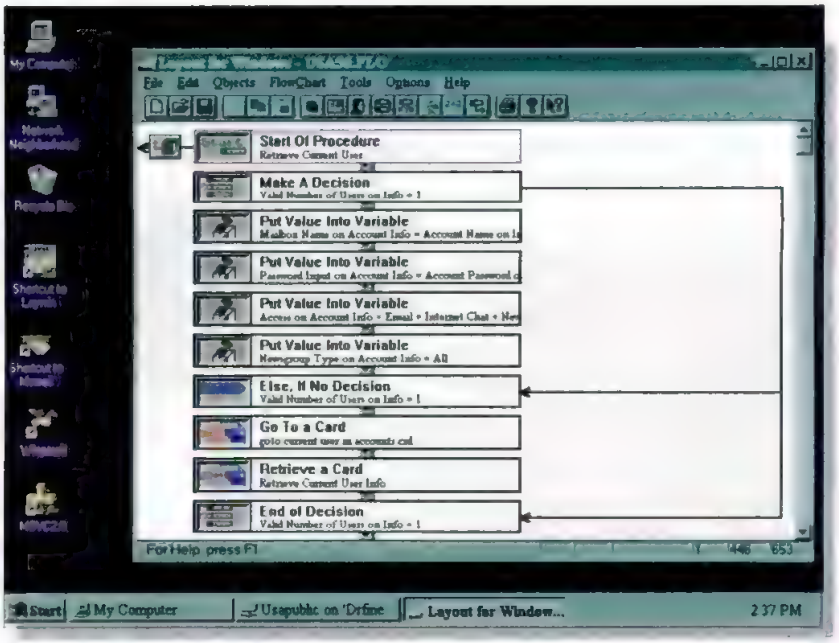

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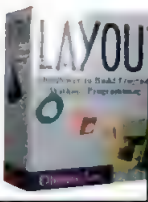

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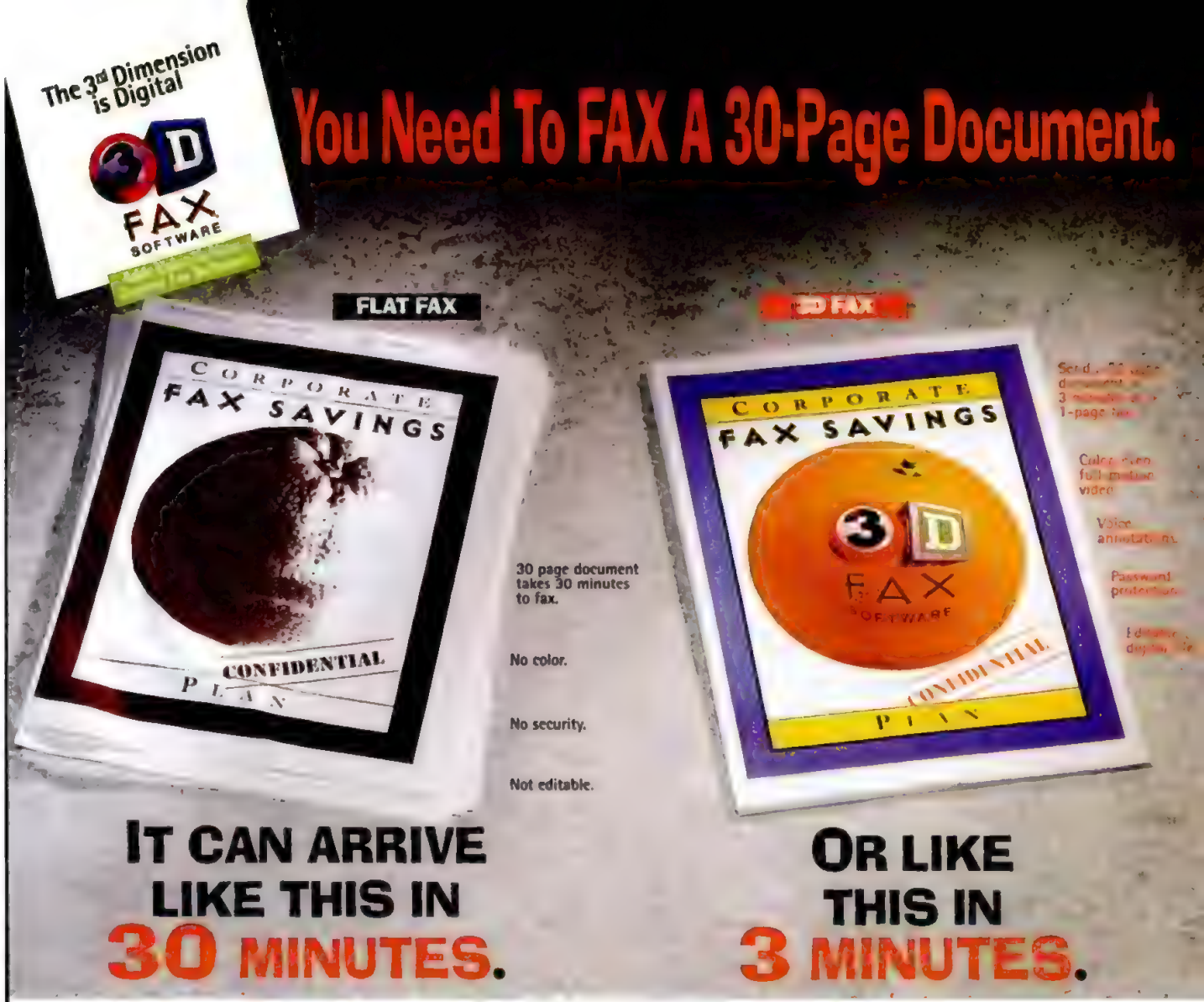

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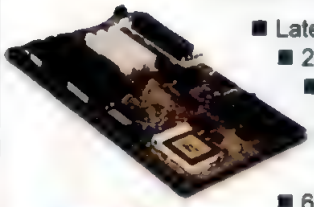

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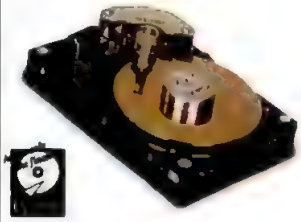

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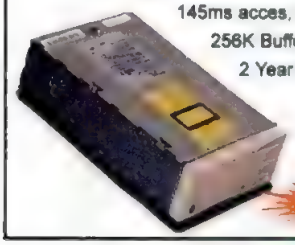

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Sound Cards

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Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	Sound Blaster 16 MultiCD MultiCD ASP	SB16AUX DRV, Ver 2 10; SB16FM DRV, Ver 1.51; SB16SND DRV, Ver 3 04	Yes Yes	Yes	N/A	Yes No	SNDBLST SYS	SB16D2 SYS Ver 2 36
	Sound Blaster 16	SB16AUX DRV, Ver 2 10; SB16FM DRV, Ver 1 51, SB16SND DRV, Ver 3.04	Yes Yes	Yes	N/A	Yes No	SB16SND SYS	SB16D2 SYS, Ver 2 36
	Sound Blaster 16 SCSI-2	SB16AUX DRV, Ver. 2.10, SB16FM DRV, Ver. 1 51, SB16SND DRV, Ver. 3.04	Yes Yes	Yes	N/A	Yes No	SNDBLST SYS	SB16D2 SYS, Ver. 2 36
	Sound Blaster 32	SB16AUX DRV, Ver. 2.11; SB16FM DRV, Ver 1.51; SB16SND DRV, Ver 3 06, SBAWE32 DRV Ver. 1.27	Yes Yes	Yes	N/A	Yes No	SNDBLST SYS, SBAWE32 SYS	SBAWED2 SYS, Ver 1.05
	Sound Blaster AWE32	SB16AUX DRV, Ver. 2.10; SB16FM DRV, Ver 1 51; SB16SND DRV, Ver 3 06 SBAWE32 DRV, Ver. 1.24	Yes Yes	Yes	N/A	Yes No	SNDBLST SYS, SBAWE32.SYS	SBAWED2.SYS, Ver 1 05
	Sound Blaster Pro Value Edition	SBPAUX DRV, Ver 2 00, SBPSND DRV, Ver. 3.02	Yes Yes	Yes	N/A	Yes No	SNDBLST.SYS	SBP2D2.SYS, Ver. 2.15
	Sound Blaster Value Edition	SB20SND.DRV, Ver. 2.03	Yes Yes	Yes	N/A	Yes No	SNDBLST.SYS	SBD2.SYS, Ver. 2 13
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	Multimedia Kit FM synthesis	OPT Sound16, Ver 1 21	Yes No	Yes	N/A	Yes No	Supported by OS	929 OS/2 Warp Minstall Ver 1 00
	Multimedia Kit Wavetable Upgradable	OPT Sound16, Ver 1 21	Yes No	Yes	N/A	Yes No	Supported by OS	929 OS 2 Warp Minstall Ver 1 00
IBM Personal Computer Co. Phone, 800-426-2968; fax 404-238-1054, BBS 919 517 0001 CompuServe GO IBM, Web site, *http://www IBM.com*	Codec Sound Card	IBMMME DRV, 6/15/94	Yes Yes	No	None	No No	None	OS2 2 1 OS2 Warp
	Sound Blaster 16 Value Edition	IBMMME DRV, 6/15/94	Yes Yes	No	None	No No	None	OS2 2 1 OS2 Warp
	Sound Blaster Midi Kit	IBMMME DRV, 6/15/94	Yes Yes	No	None	No No	None	OS2 2 1 OS2 Warp
Media Vision Inc. Phone, 510-770-8600; fax, 510-770-8648, BBS, 510-770-0527; CompuServe, GO MEDIAVISION; Internet, *TechSupp@MediaVis com*; Web site *http://www mediavis com*	Media Vision Deluxe (Mitsumi/Sony/ Panasonic)	mcwave drv, 5/19/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Media Vision Premium Deluxe (Mitsumi/Sony/ Panasonic)	pa3dwave drv, 5/23/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Media Vision Premium Deluxe (SCSI)	pa3dwave drv, 5/23/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Media Vision Pro 3D (Mitsumi, Sony/Panasonic)	pa3dwave.drv, 5/23/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Media Vision Pro 3D (SCSI 2)	pa3dwave.drv, 5/23/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	PCMCIA Sound Card	mvpswmd drv, 2/21/95	Yes No	No	None	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Audio Spectrum 16 (LMSI)	MVPROAUD.DRV, 8/26/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Audio Spectrum 16 (SCSI)	MVPROAUD DRV, 8/26/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS

N/A—Not applicable The current driver is Windows 95–compatible Note "Supported by OS" means driver support is built into the operating system

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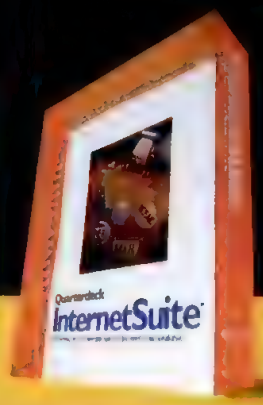

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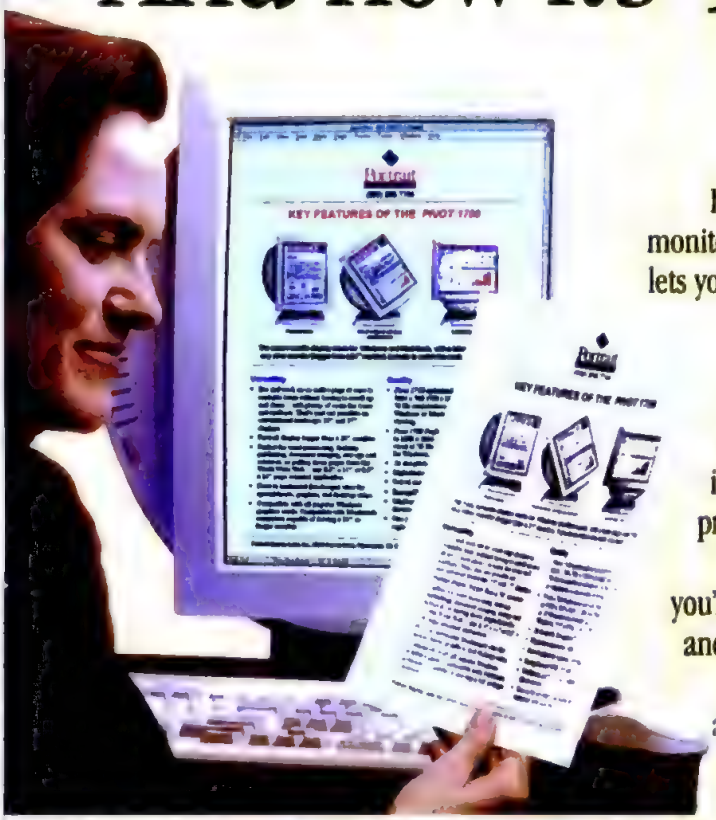

Presenting the Pivot 1700.™ The only 17" monitor – for Windows™ *and* Macintosh® – that lets you select the orientation that perfectly suits the work you're doing.

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SYSTEM REQUIREMENTS: A 386 PC, or greater, Windows 3.1/3.11 or Windows for Workgroups 3.11

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Doubling your PC's RAM is great.

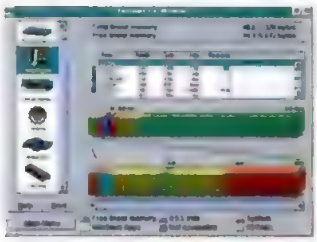
But with Hurricane™ it's just the beginning.

Hurricane – the newest brainchild from the memory magicians at Helix (creators of the award-winning NETROOM and Cloaking technology) is the first truly complete Windows™ performance enhancer.

Hurricane's RAM doubling feature gives you "unlimited" resources and boosts memory for your applications – speeding up your entire system and making "out of memory" messages a thing of the past.

But there's more...

Windows™ is now set to reach peak efficiency and velocity with Hurricane's virtual cache (for 32-bit file access), disk cache, RAM drive and print spooler, all of which share access to all your free memory.



DISCOVER how much memory you gain

But there's more...

Hurricane has its own screen accelerator* to make your system even faster, and unleashes the special features of your Pentium™ or Intel DX2/4 processor to milk it for every last ounce of performance. Plus, it's enhanced with Helix' exclusive WinGuard™ to protect your system from misbehaved applications.

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Hurricane comes equipped with **WinGauge™** for *unprecedented real-time performance analysis*. It's like flying a fighter jet with a heads up display of everything that's happening in your system. And, if you want to delve into your system's deepest secrets, tap into **Discover™** – the most complete system analysis utility ever. It's right there.

INCLUDES FREE WINDOWS 95 UPGRADE†

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KeyNotes Word 6.0

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CIRCLE 168 ON READER SERVICE CARD

Sound Cards

Continues

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95-compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	Pro Audio Spectrum 16 (Sony)	MVPROAUD.DRV, 8/26/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Audio Studio (SCSI)	MVPROAUD DRV 8/26/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Sonic (LMSI)	mciwave.drv, 5/19/94	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Sonic (Panasonic)	pros.drv, 11/12/93	Yes No	Yes	N/A	Yes Yes (BBS, CIS)	None	Supported by OS
	Pro Sonic MCD	mciwave drv 5/19/94	Yes No	Yes	N/A	Yes Yes (BBS CIS)	None	Supported by OS
Mediatrix Peripherals Inc. Phone 800-820-8749 fax 819-829-5700 BBS 819-829-5101 CompuServe, GO MEDIATRIX Internet, *sales [illegible]x.com*, Web site, *http://www.fmmo.ca/media-trix*	Audiotrix Pro	OPL4 DRV, Ver 1.02	Yes No	Yes	N/A	No Yes (BBS, FTP Web)	None	None
		CS31BA11 DRV Ver 2.0G	Yes No	Yes	N/A	Yes Yes (BBS, FTP Web)	CS31BA11 DRV, Ver 1.61	CS4231.SYS Ver 1.05
		YSS225 DRV, Ver. 1.0MTRIX	Yes No	Yes	N/A	No Yes (BBS, FTP, Web)	None	None
miro Computer Products Inc. Phone 416-665-0940 fax 416-665-[illegible]4 BBS 416-[illegible]-9944, CompuServe GO MIRO; [illegible] *support@miro.[illegible]usa.com*	miroCONNECT 34 wave	miro Sound Drivers Ver 1.20	Yes No	Yes	N/A	No Yes (BBS, CIS)	None	None
	miroSOUND FM10	miro Sound Drivers, Ver 1.20	Yes No	Yes	N/A	No Yes (BBS CIS)	None	None
	miroSOUND PCM1 pro	miro Sound Drivers Ver 1.20	Yes No	Yes	N/A	No Yes (BBS, CIS)	None	None
	miroSOUND PCM10	miro Sound Drivers, Ver 1.20	Yes No	Yes	N/A	No Yes (BBS, CIS)	None	None
	miroSOUND PCM12	miro Sound Drivers, Ver. 1.20	Yes No	Yes	N/A	No Yes (BBS, CIS)	None	None
	miroSOUND PCM20 radio	miro Sound Drivers, Ver. 1.20	Yes No	Yes	N/A	No Yes (BBS, CIS)	None	None
Multiwave Innovation Inc. Phone 408-[illegible]-900 fax 408-[illegible]-292 BBS 408-[illegible]-927 CompuServe 74224,266	audiowave 16 AISP	AW16AISP DRV	Yes No	No	None	No No	None	None
	audiowave AWS 32	MWSYS Ver 1.22	Yes No	No	9/95	No Yes (BBS, Web)	MWSYSnt	MWSYSos2
	audiowave Green 16	ES1688WN DRV	Yes No	No	9/95	No Yes (BBS Web)	None	ESS_os2
	audiowave Platinum 16	P16 DRV	Yes No	No	9/95	No Yes (BBS Web)	MWSYSnt	MWSYSos2
	Dreamwave Wavetable Synthesizer	Roland MPU 401 windows	Yes No	No	9/95	No Yes (BBS Web)	None	None
	Moviewave Interactive	MWI Ver 1.40	Yes No	No	9/95	No Yes (BBS, Web)	None	None
	Moviewave Interactive Plus	MWI Ver 1.40	Yes No	No	9/95	No Yes (BBS Web)	None	None
	Moviewave Studio	MWS Ver 2.5	Yes No	No	9/95	No Yes (BBS, Web)	None	None
New Media Corp. Phone 714-453-3100 fax 714-453-[illegible]4 BBS 714-453-0214	WAVjammer	WAVJAMMR.SYS Ver 1.24	Yes No	No	MSSNDSYS DRV, MSSNDSYS EXE Ver 4.00	Yes Yes (BBS)	None	None
Orchid Technology Phone 510-[illegible]-300 fax 510-[illegible]-[illegible]2 BBS 510-683-0327 CompuServe GO ORCHID Internet *tech_support@orchid.com* Web site *http://www.netscape.orchid.com*	GameWave 32	SNDBLST2 DVR 3/10/92	No No	No	None	No Yes (BBS CIS Web)	None	None
	GameWave 32Plus	SW32 DRV Ver 1.4	Yes No	No	None	No No	None	None
	NuSound PnP	NUSOUNDW DRV, Ver 1.2	Yes No	Yes	N/A	No Yes (BBS, CIS Web)	Supported by OS	Supported by OS
	SoundDrive 16 EZ	AUDDRV DRV Ver 1.2	Yes No	Yes	N/A	Yes Yes (BBS CIS Web)	Supported by OS	Supported by OS
	SoundDrive 16+SCSI	AUDDRV DRV Ver 1.3	Yes No	Yes	N/A	Yes Yes (BBS, CIS, Web)	Supported by OS	Supported by OS
	SoundWave 32Pro	WPPSA DRV Ver 2.12	Yes No	Yes	N/A	No Yes (BBS, CIS Web)	None	None
	SoundWave 32Pro SCSI	WPPSA DRV, Ver 2.13	Yes No	Yes	N/A	No Yes (BBS, CIS, Web)	Supported by OS	None
	SoundWave 32Pro Studio	WPPSA DRV Ver 2.14	Yes No	Yes	N/A	No Yes (BBS CIS Web)	Supported by OS	None
	WaveBooster	MPU401 DRV, 3/10/92	No No	Yes	N/A	Yes Yes (BBS, CIS Web)	MPU401 DRV	None
	WaveBooster+4	MPU401 DRV 3/10/93	No No	Yes	N/A	Yes Yes (BBS CIS Web)	MPU401 DRV	None
	WaveBooster 4FX	MPU401 DRV, 3/10/94	No No	Yes	N/A	Yes Yes (BBS, CIS Web)	MPU401 DRV	None
Reveal Computer Products Inc. Phone, 800-473-8325; fax, 818-340-2379, BBS, 818-713-8188, CompuServe, GO REVEAL, Prodigy, Reveal	SC400R4G	Not named	Yes No	No	None	No Yes (BBS CIS Prodigy)	None	Supported by OS
	SC600	Not named	Yes No	No	None	No Yes (BBS, CIS Prodigy)	None	None
	SC500R1 & 2	Not named	Yes No	No	None	No Yes (BBS, CIS Prodigy)	None	Supported by OS

N/A—Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means driver support is built into the operating system.

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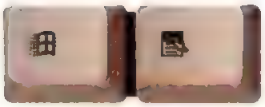

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yes It runs with NetWare

Shiva PPP

Microsoft Windows Compatible

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For business people who have more important things to do than browse the Internet.

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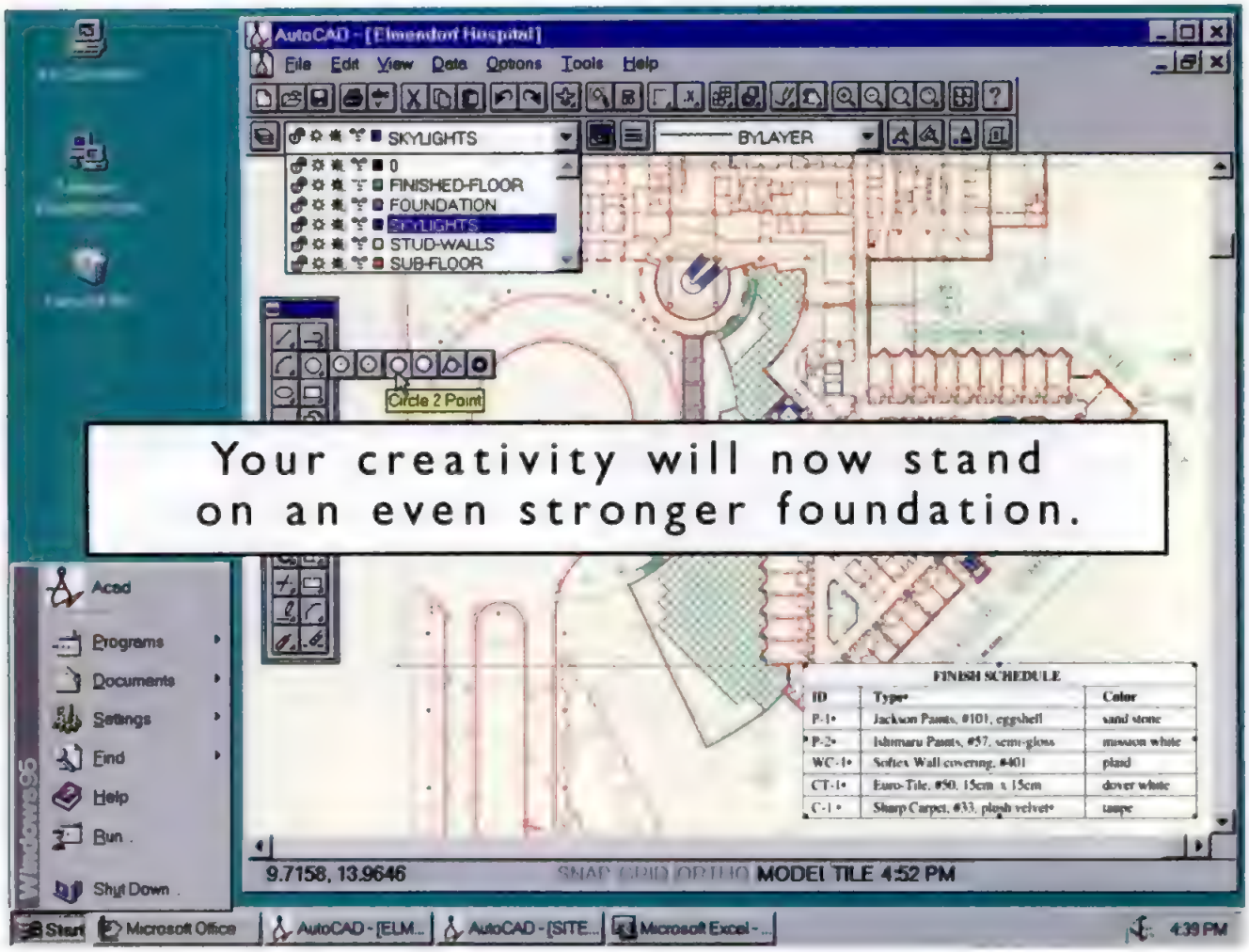
CIRCLE 087 ON READER SERVICE CARD

Sound Cards

Ends

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95-compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 driver (name, date, or version)
	SC500R3	Not named	Yes No	No	None	No Yes (BBS, CIS, Prodigy)	None	Not named
Roland Corporation U.S. Phone, 213-685-5141; fax, 213-722-0911	Roland Audio Production Card	RAP10 DRV, Ver. 2.0	Yes No	No	None	No Yes (AOL, CIS)	None	None
Toptek Multimedia Inc. [illegible] fax, 818 [illegible], BBS, 818-962-2851	Golden Sound Ver. 2.5	Sound Blaster, Ver 1.0	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Ver. 3.0	Ver. 1.03	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro Deluxe/MCD	Ver. 1.03	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro III/MCD	Ver. 1.03	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro 16 A+/MCD	cd31ba11	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro 16 ES/MCD	cs31ba11	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro 16/MCD	Ver. 1.03	Yes No	No	None	No Yes (BBS)	None	None
	Golden Sound Pro 16 Plus/MCD	Ver. 1.04	Yes No	No	None	No Yes (BBS)	None	None
	GS-32 Wavetable Upgradable Card	roland mpu-401	Yes No	No	None	No Yes (BBS)	None	None
Turtle Beach Systems [illegible] BBS, 717-767-5934, CompuServe, GO TURTLE; Internet, *support@tbeach.com*	Monte Carlo	Mcarlo drv, 1/25/95	Yes No	No	8/95	Yes No	None	7/95
	MultiSound	Mult Sound drv 4, 21-93	Yes No	No	8/95	Yes No	None	None
	MultiSound Monterey	Tahiti drv, 1/17/95	Yes No	No	8/95	Yes No	None	7/95
	Tropez	Tropez.drv, 5/19/95	Yes No	No	8/95	Yes No	None	7/95

N/A—Not applicable. The current driver is Windows 95-compatible. Note: "Supported by OS" means driver support is built into the operating system.



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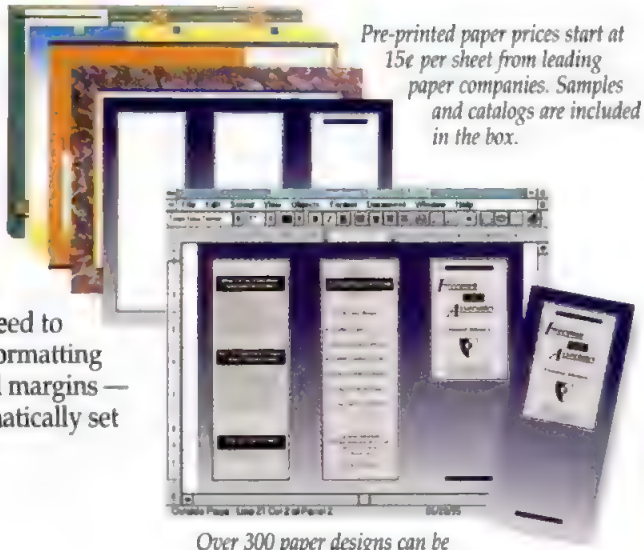

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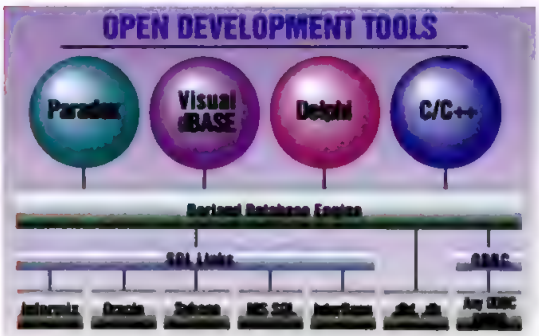

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SCSI Cards

If your CD-ROM drive, removable hard disk controller, or other device is currently jacked into your computer via a SCSI card, don't fret. You can still use the existing 16-bit drivers under Windows 95. In addition, there are currently 70 different SCSI-card models supported by Windows 95 right out of the box.

For new cards, vendors can simply write what's known as a "miniport" driver. Instead of rewriting a full-blown driver for each new card, a vendor can create something akin to a short description of the new card and plug it into the general 32-bit driver that already exists in Windows 95.

Plug and Play–ready SCSI cards should be automatically detected by Windows when you use the Install New Hardware wizard. SCSI cards will also benefit from the existence of Windows 95's new Configuration manager. Actually part of the new Virtual Memory manager (VMM32), the Configuration manager gathers device information off the bus. This includes the IRQ, the I/O port address, and other details. It then takes this information and manages it so that you don't have to worry about freeing an address to install new hardware. This wards against interrupt conflicts that can crash or immobilize your system.—*LU*

THE DRIVER MANUAL

SCSI Cards

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 (name, date, or version)
Advansys Phone, [illegible] 9400 fax [illegible] BBS, [illegible] CompuServe [illegible] ADVANSYS Internet support@advansys.com, Web site, http://www.advansys.com	EISA Dual Bus Master	ASC MPD Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS CIS Web)	ASC DSK Ver 2.4	ASC ADD Ver 2.4
	EISA Single Bus Master	ASC MPD, Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK, Ver 2.4	ASC ADD, Ver 2.4
	ISA Bus Master SCSI	ASC MPD Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK, Ver 2.4	ASC ADD Ver 2.4
	PCI Bus Master SCSI	ASC MPD, Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK, Ver 2.4	ASC ADD, Ver 2.4
	PCI Connection Bus Master SCSI	ASC MPD, Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK Ver 2.4	ASC ADD Ver 2.4
	PCI Dual Bus Master SCSI	ASC MPD, Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK Ver 2.4	ASC ADD Ver 2.4
	Personal PCI Bus Master SCSI	ASC MPD, Ver. 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK Ver. 2.4	ASC ADD Ver 2.4
	VL Bus Master SCSI	ASC MPD, Ver. 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS Web)	ASC DSK Ver 2.4	ASC ADD Ver 2.4
	VL Dual Bus Master SCSI	ASC MPD, Ver 2.4	Yes Yes	Yes	N/A	No Yes (BBS, CIS, Web)	ASC DSK, Ver 2.4	ASC ADD, Ver 2.4
Bus Logic Inc. Phone, 800-707-7274; fax, 408-492-1542, BBS 408-492-1984, Internet, info@buslogic.com, Web site, http://www.buslogic.com	EISA Fast SCSI	SW-191, Ver. 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	EISA Fast SCSI BT-747C	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	EISA Fast/Wide SCSI	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	EISA Fast/Wide SCSI/ BT-757C	SW-191, Ver. 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	KT-545C SCSI Accelerator for PC/AT	SW-191 Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	KT-747C SCSI Accelerator EISA	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	KT-757C Fast/Wide SCSI Accelerator for EISA	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	KT-946C SCSI Accelerator for PCI	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	KT-956C Wide SCSI Accelerator for PCI	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Micro Channel Fast SCSI	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	Micro Channel Fast SCSI/BT-646S	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	PC/AT Fast SCSI/ BT-545C	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	PCI Fast SCSI/ BT-946C	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	PCI Fast SCSI/ BT-956C	SW-191, Ver 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
	PCI Fast/Wide SCSI	SW-191, Ver. 4.0	Yes No	Yes	N/A	Yes Yes (BBS)	Supported by OS	Supported by OS
Future Domain Corp. Phone, 714-253-0400; fax, 714-253-0913, BBS, 714-253-0432; Internet, support@fdc.mhs.compuserve.com	MCS-700	V18FCAMD 386, Ver 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2.0
	MCS-700SVP	V18FCAMD 386, Ver 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2.0

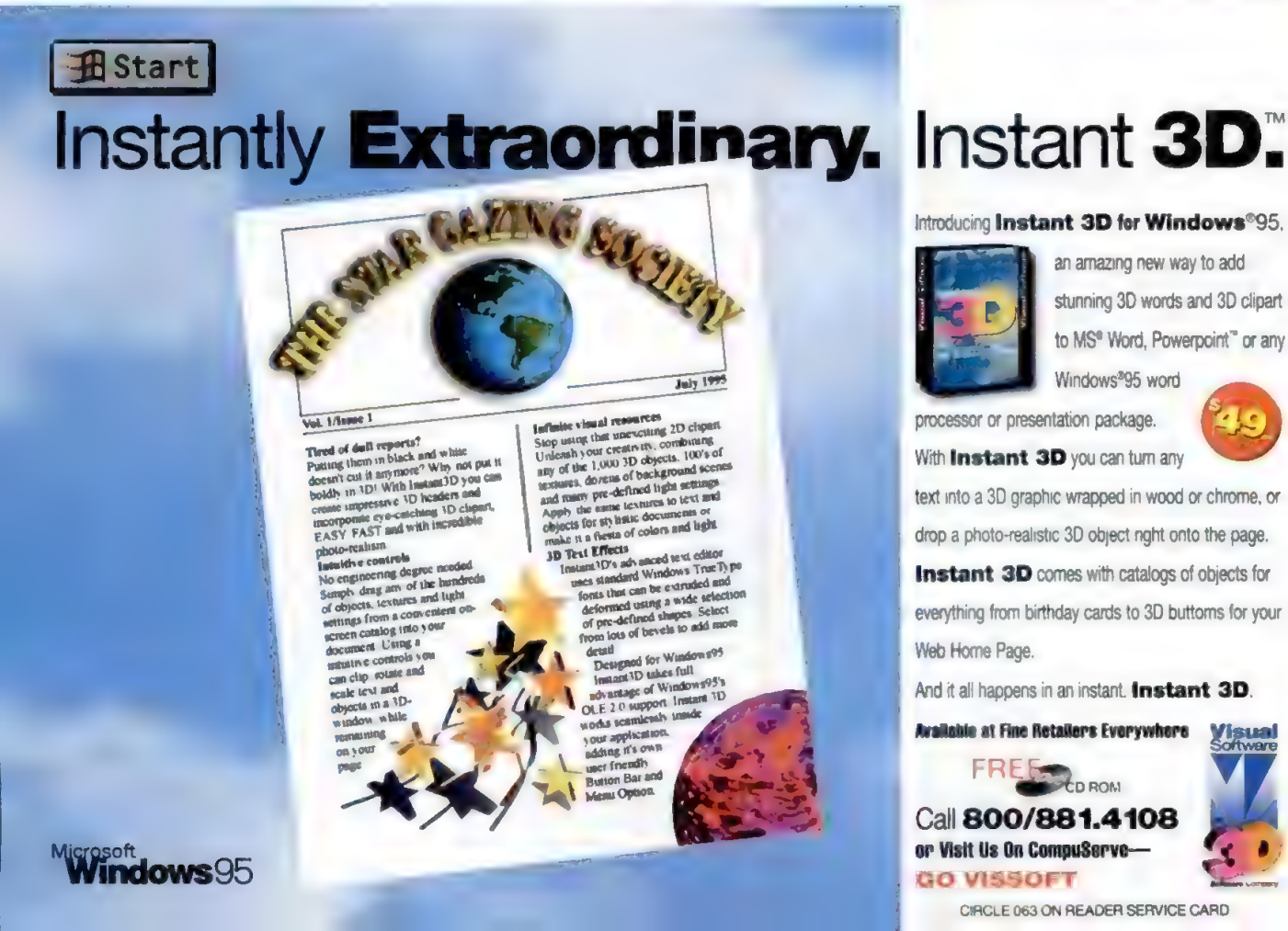
N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.

SCSI Cards

Ends

Company	Product name	Current driver (name, date, or version)	16-bit driver/ 32-bit VXD	Win 95–compatible	Win 95 update driver (or date, if one is planned)	Driver support built into Win 95/Win 95 driver on-line	Windows NT 3.5 driver (name, date, or version)	OS/2 Warp 3.0 (name, date, or version)
	PlugNPlaySVP	V18FCAMD 386, Ver 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16 700 ADD, Ver 2 0
	PNP-1630	V18FCAMD 386, Ver. 4 0	No Yes	No	FD16_700.MPD	Yes Yes (BBS)	FD16-700 SYS	FD16-700 ADD, Ver 2 0
	PNP-1640	V18FCAMD 386, Ver 4.0	No Yes	No	FD16_700.MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver. 2.0
	SCSI2GO	V18FCAMD.386, Ver 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2.0
	SCSI2GOSVP	V18FCAMD 386, Ver 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700.SYS	FD16-700 ADD, Ver 2 0
	TMC-850MCD	V18FCAMD 386, Ver 4 0	No Yes	No	FD8XX MPD	Yes Yes (BBS)	FD8XX SYS	FD16-700 ADD, Ver 2.0
	TMC-1610M	V18FCAMD.386, Ver 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2.0
	TMC-1610MCD	V18FCAMD 386, Ver. 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700.SYS	FD16-700 ADD, Ver 2.0
	TMC-1660	V18FCAMD 386, Ver. 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver. 2.0
	TMC-1660SVP	V18FCAMD 386, Ver. 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver. 2.0
	TMC-1670	V18FCAMD 386, Ver 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2.0
	TMC-1680	V18FCAMD.386, Ver 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver. 2.0
	TMC-1680SVP	V18FCAMD 386, Ver. 4 0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver. 2.0
	TMC-3260	V18FCAMD 386, Ver 4.0	No Yes	No	FD16_700 MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700 ADD, Ver 2 0
	TMC-3260SVP	V18FCAMD.386, Ver 4 0	No Yes	No	FD16_700.MPD	Yes Yes (BBS)	FD16_700 SYS	FD16-700.ADD, Ver. 2.0

N/A—Not applicable. The current driver is Windows 95–compatible. Note: "Supported by OS" means driver support is built into the operating system.



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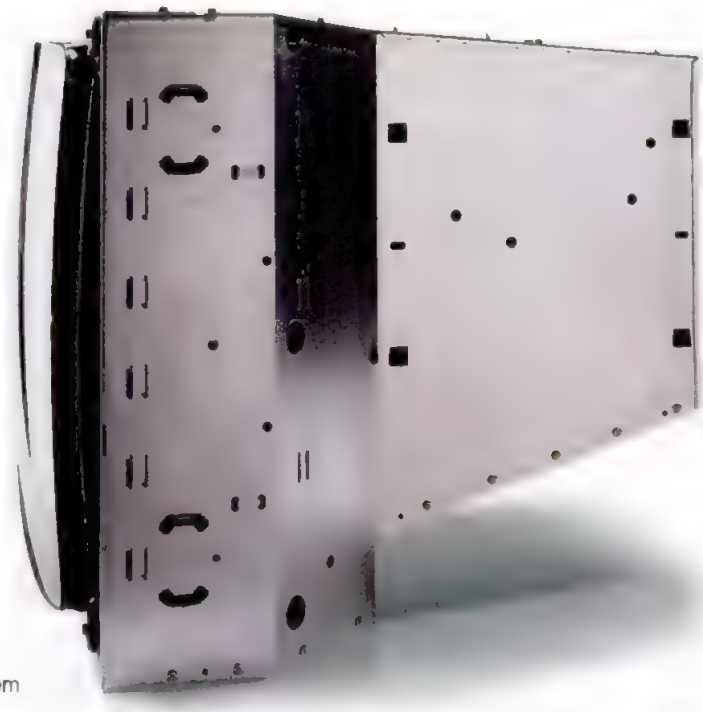

Automobiles aren't the only European imports to set engineering standards. Witness Nokia's 445X 21" monitor. It showcases the highest possible resolution combined with the quickest refresh rate for any monitor its size. The result is what *Imaging Magazine* called "added insurance that the user won't get fatigued." Or, as *PC Week Labs* expressed it, "Nokia's Multigraph 445X is big and beautiful to look at."

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	280x1024	1600x 200
MODE						
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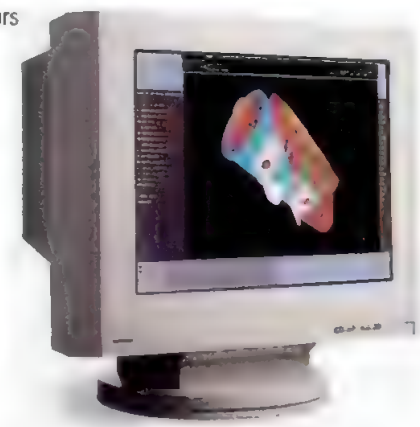

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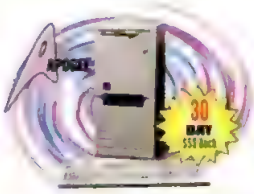

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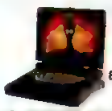

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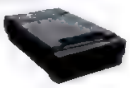

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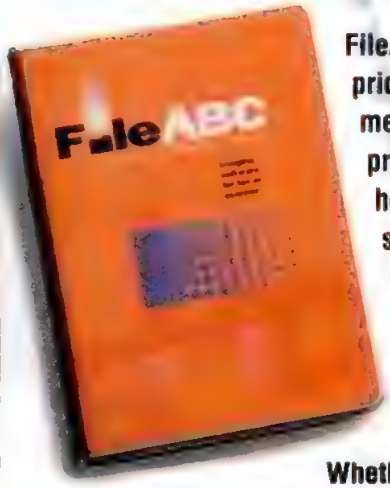

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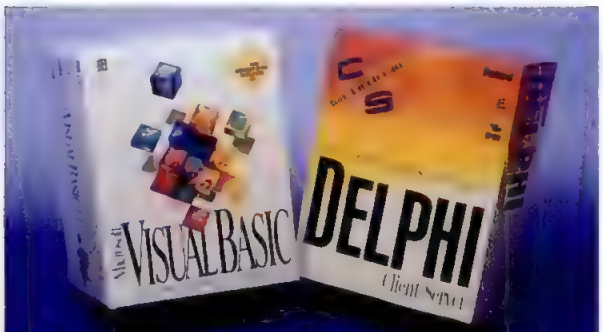
Visual Basic and Delphi Head to Head

With a true compiler and object-oriented language, Borland's Delphi looks to the future. Is it ready to topple Visual Basic?

By Stephen W. Plain

With all of the visual development tools on the market today, it's worth remembering that early Microsoft Windows 3.*x* development was anything but visual. Building a native Windows application back then demanded a certain type of programmer: one who'd mastered C and the Windows API—and who was blessed with a bottomless store of patience. Then Visual Basic (VB) came along and changed everything. The Ford of development tools, it brought Windows development to the masses and eliminated the laborious chore of writing UI code to create each form and button. It was built on Basic, a language almost anyone could learn, and it made building event-driven applications easy, simply by attaching Basic code to visual controls.



Visual Basic is a classic RAD tool with a strong following and a huge after-market of add-ons. Serious development demands the use of third-party controls, but VB's low price ensures that you can afford them. A significant upgrade that addresses many limitations of the current product is just around the corner.

Delphi is an intriguing and powerful development tool that combines a visual development system, an object-oriented language, and a native-code compiler. It pioneers a new RAD paradigm that others are sure to follow. You must learn Pascal and take a strict OO approach, but you can leverage VBX components.

VB was also an interpreted language system, so you could test and debug your application on the fly from within the development environment. And it was extensible. Prewrit-

Icons by Hugh Whyte

IN THIS SECTION

TUTOR If the Windows 95 shell is new and unfamiliar territory, Jeff Prosise offers a guided tour to get you started in the right direction. Beginning with basics like shortcut creation, context menus, and property sheets, he moves on to advanced topics such as customizing menus by merging new files into the registry. You'll also learn a trick for listing all the DLLs implicity loaded by an executable. *page 513*

POWER PROGRAMMING This issue, we revisit the WinHelp system, showing how you can use little-known features to call the Windows API from WinHelp. We also show how you can use undocumented features to attach a DLL to someone else's help file. With Windows 95 around the corner, we also survey major changes and enhancements coming to the WinHelp engine. *page 536*

INSIDE OS/2 One of OS/2 Warp's most powerful features is its object-oriented Workplace Shell, but all too often users are left to discover its power on their own. We offer a walk-through of some basic WPS objects including folders, program objects, data objects, shadows, and the Launchpad, showing how you can manipulate and customize each one. We also demonstrate adding menu items to object menus. *page 542*

UTILITIES Our WinBar utility offers a slick Windows 95-style Taskbar that runs under Windows 3.1. You can use this highly configurable program launcher either as a Windows enhancement or as a full replacement for the Windows shell. Author Douglas Boling also details the ins and outs of the owner-drawn menus that form the core of WinBar's functionality. *page 546*

ALSO IN THIS ISSUE PC Solutions exposes all the gory details of Windows 95's boot-up procedure. Neil J. Rubenking shows you how to unveil CONFIG.SYS and AUTOEXEC.BAT and even how to eliminate the Windows 95 logo screen. You'll also find an ingenious batch file that lets you create multiple levels of subdirectories at the same time. *page 555*

ten functions in the form of custom controls could simply be plugged into the environment, ready for use in your program. The combination was revolutionary. Suddenly, there was a quick way to build complex, powerful, professional-looking Windows applications.

Initially, Microsoft seems to have thought of VB as a general-purpose tool. But VB quickly caught the attention of corporate developers building client/server applications, because it was so well suited for rapid application development (RAD) methodologies that stressed iterative development, fast turnaround, and user involvement in prototyping. It was inevitable that other RAD development systems would adopt a VB-like approach. In fact, tools loosely based on the VB paradigm have come to dominate client/server development. These VB competitors—including runaway successes like Powersoft Corp.'s PowerBuilder—provide a visual interface that lets you paint an interface by dropping and resizing controls and database connections onto forms. They also typically offer integrated development environments (IDEs) that let you add specialized controls and customize things to your liking. Generally, these tools also attempt to address the problem of code reuse, a big concern of corporate IS shops striving to make developers more productive over time. A few also tackle the code performance issues raised by an interpreted system, usually by generating source code that can be compiled to true machine code.

VB'S CLASSIC INTERFACE *includes the Properties window for setting the properties of objects and controls.*

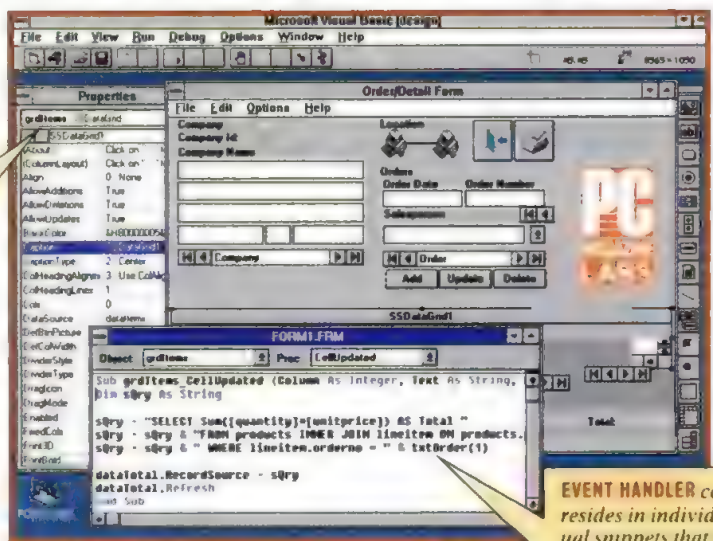


FIGURE 1 *The Visual Basic 3.0 IDE*

EVENT HANDLER *code resides in individual snippets that are accessed by double-clicking on the associated object.*

currently shipping versions of Delphi and VB that are specifically geared toward client/server development: Borland's Delphi Client/Server and Microsoft Visual Basic 3.0, Professional Edition. We invited Borland and Microsoft to come to PC Magazine Labs to help us construct an application fragment representative of a real-world database front end. Both development systems easily fulfilled the requirements of our test script; our test application, however, highlighted the major differences between them and helped us ferret out some interesting particulars. Both products will soon be appearing in 32-bit versions, more or less coinciding with the release of Microsoft Windows 95. While most of the fundamental features described in this story that distinguish them will not change, both will receive significant enhancements (for details, see the sidebar "Targeting Windows 95").

MEET THE CHALLENGER

Of these VB competitors, Borland International's Delphi is perhaps the most interesting to come along since VB itself. It borrows the best of the VB visual paradigm while breaking new ground in the areas of code reuse and performance. With Delphi, Borland has raised the bar for RAD tools by coupling a highly productive visual design environment with a true compiler, a powerful object-oriented programming (OOP) language and a generous set of tools. Delphi is based on Pascal, a language many of us worked with in school. Its fresh approach to RAD provides an interesting mix of productivity and power, and its specialized client/server tools let it compete with the likes of PowerBuilder and Gupta Corp.'s SQLWindows.

We did a side-by-side comparison of the

BEYOND TRADITIONAL LANGUAGES

Visual as these two products are, Delphi and VB both rely on traditional programming languages for their robustness. Delphi and VB use existing languages: Pascal and Basic; their respective dialects include significant extensions to each, however. VB's flavor of Basic extends the language with the concept of objects, properties, and methods, referenced through the now-ubiquitous object-dot-property notation. VB also extends Basic to make it an inherently event-driven development system (Figure 1). While standard Basic programs execute line by line using essentially a single body of code, VB breaks your code up among various event-handler routines that respond to particular events. From the moment the first form loads in a VB application, all code execution occurs in response to events. Coding in VB is a process of designing the forms—the look of an application—and then defining the various behaviors to occur as a result of particular events.

Borland built Delphi around its powerful Object Pascal language. Though Object Pascal's roots are in standard Pascal, it includes true object orientation with support for inheritance, encapsulation, and polymorphism. The Pascal derivative in Delphi is sophisticated and powerful, yet easier to comprehend and manage than C++. Like VB, Delphi uses dot notation to reference objects' properties and methods. Unlike VB, however, the Delphi language relies consistently on objects and allows you to create your own classes by subclassing from other objects and inheriting their properties and methods. This powerful feature, the cornerstone of OOP, gives you significantly more control in creating well-structured applications. It's also an excellent vehicle for code reuse.

Which language you feel more comfortable with depends on your perspective. Without a doubt, VB is the easier of the two to learn. You simply can't beat Basic for its simplicity and readability. VB is also more forgiving of poor coding style, making it more friendly to new programmers. One example of this is VB's default Variant data type. A Variant can handle numeric, string, or date/time values. While the Variant type makes it easy to code without considering the data types of your variables, it can also lead to sloppy coding and wasteful use of system memory (Microsoft recommends that a Variant be used only in certain special cases). Delphi, on the other hand, is anything but forgiving in this respect.

Since Pascal is a strongly typed language, you must declare all variables with their respective types before using them. You also have to take care to use the appropriate data types with functions to avoid type-mismatch errors during compilation. For VB coders who are not accustomed to declaring all of their variables explicitly, this element of Delphi can take some getting used to. It does, however, make for a well-organized program, since you are more likely to conserve variable storage, and all of the variables appear clearly in the Var block of each object's code. VB provides an Option Explicit statement, which can force you to declare your variables similarly (and Microsoft recommends its use), but this feature is optional.

INTERPRETED VS. COMPILED

One of the biggest architectural differences between Delphi and VB is the way each compiles its code. VB is based on a language interpreter that translates code into machine in-

structions at runtime, while Delphi compiles its Pascal source code directly into machine code and builds a standalone executable. While compiled executables are always faster than interpreted code, the speed advantage will vary in degree depending on the nature of the application. Applications that are processing-intensive, perform heavy number crunching, or make heavy use of large loops and arrays reap the most benefit from compiled code. Database front ends that are primarily constrained by data-access performance will gain less. Delphi uses Borland's well-respected Pascal-compiler technology to build highly efficient code. Not only does Delphi enable you to create standalone .EXEs and .DLL's, but it eliminates the distribution hassle VB programmers face of having to include the appropriate runtime .DLL file with an application.

Although VB works at decoding application commands at runtime, it does not use a purely interpretive technique. As you leave each line of new source code in the design environment, VB tokenizes that line into an intermediate representation. VB maintains this "in-between" code while you continue to work in design mode. When you choose the Compile or Run commands, your source code compiles to pseudo-code (p-code), a series of processor-independent codes that represent a series of machine instructions. Since the code has been precompiled, the application can start to run very quickly.

When you select the Make EXE option, VB builds an executable file that contains the p-code for the application, as well as the necessary executable header and startup code. When you run the VB-created .EXE file, the VB runtime .DLL file VBRUN300.DLL loads to translate the program's p-code to machine instructions. While this approach is slower than running true compiled machine code, it can produce smaller .EXE files. This footprint advantage increases as you run multiple applications or instances of applications. All VB applications share the same instance of the runtime .DLL in memory, so the memory footprint is far less than with multiple instances of completely compiled .EXEs.

One big advantage of an interpreted system such as VB is that you can test and debug portions of the application within the environment at any time. While most traditional tools force you to go through separate compile and link steps to test an app, Delphi offers an on-the-fly compile and link that lets you test in the development environment as you go, much as VB does.

BUILDING WITH FORMS

Both Delphi and VB base the development of the visual aspect of your program on forms.

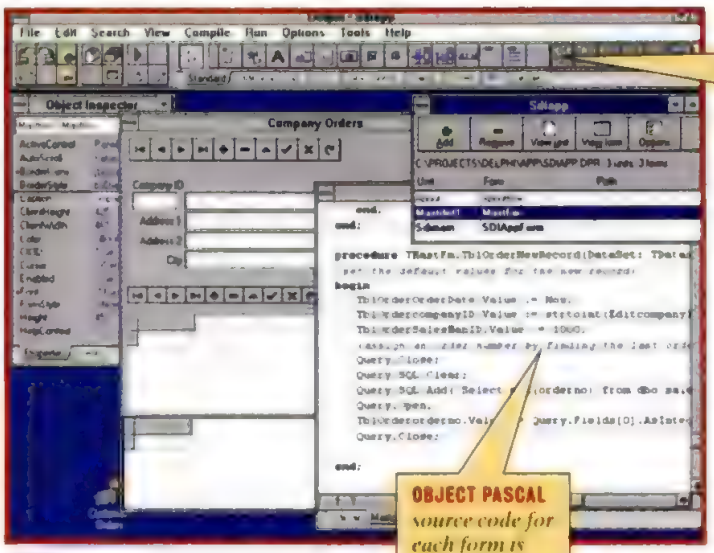


FIGURE 2 *The Delphi Client/Server IDE*

DELPHI COMPONENTS *are accessed through a series of tabbed palettes organized by type.*

OBJECT PASCAL *source code for each form is stored as a contiguous block.*

Each product lets you design and keep open multiple forms for your application. Both programs provide project windows that let you manage the various files in your application and save them collectively as independent projects. The functional interface elements that you place on your forms—buttons, sliders, list boxes, and all the other visual controls that can initiate or respond to events—are similar in concept between Delphi and VB, but the interface you use to manage them is slightly different, as is the terminology.

In Delphi, visual and nonvisual components are available in a floating, tabbed window called the Component Palette, which normally appears horizontally at the top of the screen (Figure 2). Components reside on pages labeled Standard, Additional, Data Access, Data Controls, Dialogs, System, VBX, and Samples. These pages can be fully customized, and new pages can be added. VB uses a simpler approach called the Toolbox. This is simply a floating palette of icons representing the program's controls. You can add and delete Toolbox controls, but you cannot organize them into groups.

Although both products offer a similar design interface, they store their form information in very different ways. VB saves each form as a binary file with an .FRM extension. This .FRM file also contains any event-handler code you have written. Additionally, your program can contain standalone code modules with the standard .BAS Basic source-code extension. These modules are not tied to forms and typically contain global declarations and general-purpose functions.

Delphi uses two files to store the information associated with each form. The first, a binary file with a .DFM extension, stores the visual aspects of each form such as height, width, and color. Another file stores the code associated with the form as a contiguous block. This file, and every Delphi source file, uses the .PAS Pascal extension and is called a *unit*. A new form is derived from the standard Delphi class TForm and created as a new class definition in the unit file. Creating a new form might produce a type definition `TForm1=class(TForm)`, for example.

As you place components on the form, new instances of each component's class automatically appear inside the form object within the current form's unit file.

While VB presents the event-handler code in each form as a series of individual so-called "snippets" attached to the various controls, Delphi organizes them as separate procedures within a single, contiguous code module. In VB, you can only view the

DELPHI VS. VB 3.0: AT A GLANCE

	Borland Delphi Client/Server	Microsoft Visual Basic 3.0 Professional Edition
Price	$1,999.95	$339.00
Visual forms design	✔	✔
On-the-fly testing and debugging	✔	✔
Language	Object Pascal	Basic
Object-oriented	✔	
Executable code	Machine code	P code
Compiler supports	EXE DLL	EXE
Supported controls	Delphi Components VBX	VBX
Local database engine	Borland Database Engine	Microsoft Access 1.1 engine
Native SQL drivers included	✔	✔
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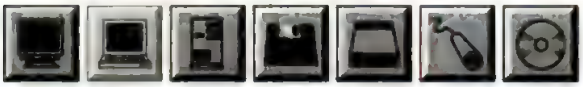

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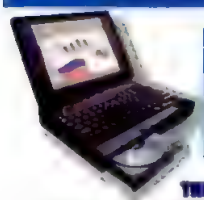

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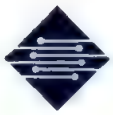

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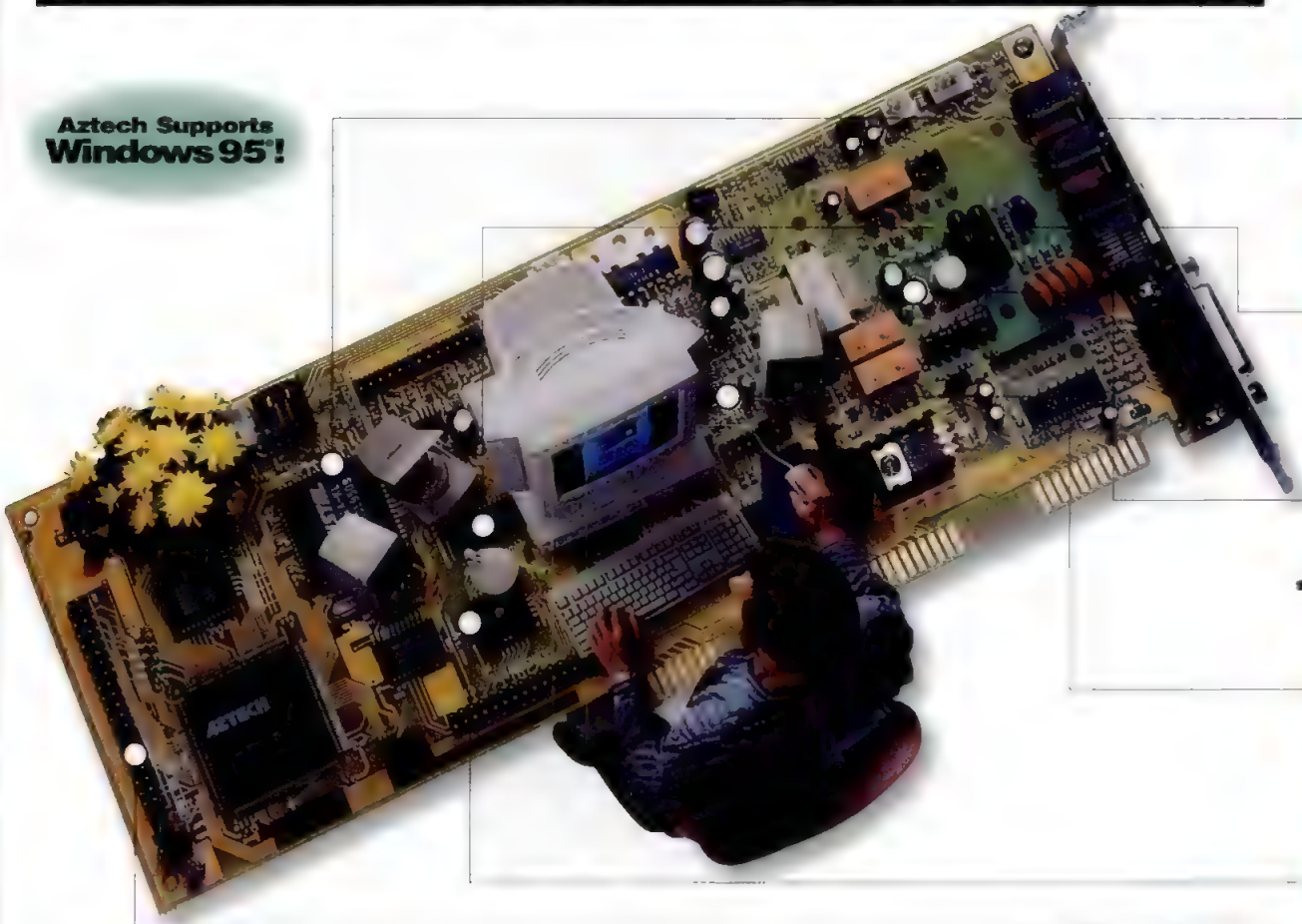

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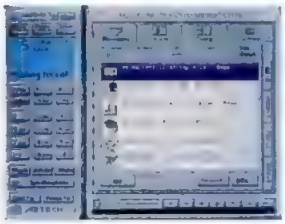
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snippets individually, while in Delphi you can view them all at once. Programmers accustomed to working with traditional procedural code will feel more at home with Delphi's approach.

Once you place controls and components on a form, each product gives you a way to set their properties through a GUI interface. VB's Properties window lists all of the properties associated with the selected control or form. To attach code to one of an object's event handlers, you can double-click that object and then select the desired event handler (DblClick, for example), from a drop-down list box. When you double-click for the first time on a control, VB will bring up that control's default handler. For example, double-clicking on a new command-button control will start a new subroutine called Command1_Click().

Delphi makes properties and events accessible through a single dialog with two pages, called the Object Inspector. Double-clicking on the procedure name associated with an event brings up the form's unit file and starts you off with the framework for the procedure for that event. When you add a component to a form, Delphi creates a field for that component in the form's class in code; the component's methods then become part of the form's class. Adding a procedure to respond to the click event for Button1 on Tform1 produces `TForm1.Button1Click`, for example.

CUSTOM CONTROLS

Although Delphi and VB both provide the flexibility to add custom controls to their environments, Delphi definitely has the upper hand in this department. In VB, custom controls use the .VBX format, a Microsoft-defined component format designed to extend the VB environment. There are many hundreds of third-party VBX custom controls that provide unique functionality or plug gaps in VB's core feature set. VBXs, however, are special DLL's usually written in C/C++; you can't create them in VB. In contrast, you can write Delphi's components in Delphi. In fact, Delphi's interface itself was written in Delphi.

To create your own Delphi components, you can either subclass any existing Delphi component or write your own from scratch. Once you've written the actual unit for your component, you register it with Delphi's Visual Component Library, which automatically recompiles to include it. Though creating a component from scratch is an involved process, subclassing existing components is straightforward; Delphi includes Component Expert, which steps you through creating a new component based on an existing one. You can also add standard VBXs to the Delphi environment, which puts a component wrapper around them. You can even extend the ca-

Targeting Windows 95

By Stephen W. Plain

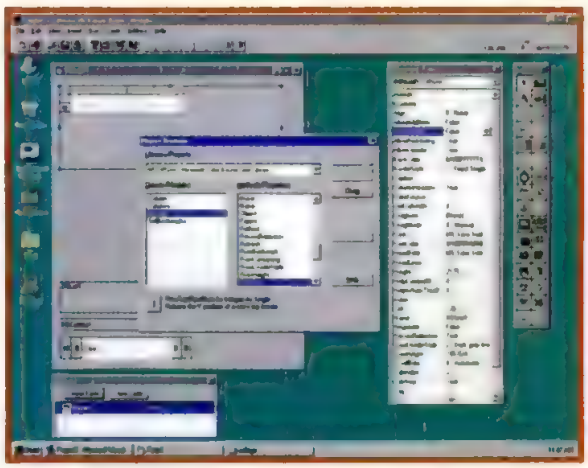
As we go to press, Borland and Microsoft are readying 32-bit releases of Delphi and VB in anticipation of a late summer release of Microsoft Windows 95. Both aim to let you create Windows 95 logo–compliant software. While the changes slated for both tools will be significant, they won't really alter the fundamental differences between them discussed in this article.

VB UPGRADE: MORE THAN OVERDUE

Unlike the still-fresh Delphi, VB 3.0 has been around for over two years and is overdue for an upgrade. By the time you read this, that upgrade may be here. Visual Basic, Version 4.0, will be a native 32-bit tool and will include a number of new features targeted at sophisticated corporate development. At the same time, it will maintain a high level of source-code compatibility and a consistent development interface with the previous release. Microsoft's aim is to achieve a near-seamless migration of existing applications to the new environment.

VB 4.0 is slated to ship in three editions: Standard, Professional, and Enterprise. While the Standard and Professional editions will be comparable to the 3.0 versions of the same names, the Enterprise edition is brand-new and aimed at serious RAD development teams. The Professional and Enterprise editions will be offered in both 16-bit and 32-bit versions while the Standard edition will be offered only in a 32-bit version.

All the new VB releases will provide OLE custom control (OCX) equivalents for all current controls. They will also include several Windows 95–specific interface controls including an end-user customizable toolbar, a status bar, tabbed dialogs, a rich-text edit control, and a tree control. The new nonvisible SysInfo control will let your program respond to Plug and Play events. Third-party developers are moving quickly to provide OLE versions of their existing VBX controls, and many will be available at the time of VB 4.0's initial release.



New tools in VB 4.0 include an object browser for examining methods and properties of OLE controls.

With Version 4.0, Microsoft will better integrate VB with its other products. Changes to the language's syntax will bring the new release into conformity with Visual Basic for Applications (VBA), the language used by other programmable Microsoft applications such as Microsoft Access 95, Microsoft Excel, and Microsoft Project. VB 4.0 will also use the same runtime language engine as Access 95 does, so only one instance of the runtime DLL will need to be on your system. With these changes, Microsoft's application-language strategy makes more sense than ever before.

VB 4.0 will include the same 32-bit Jet 3.0 engine slated for Access 95. This should eliminate the confusion and compatibility issues that cropped up with VB 3.0 while providing more flexibility and better performance. Jet 3.0 will support fat cursors, letting you control the number of rows retrieved at a given time in a client/server application.

Microsoft also hopes to counter what it feels is the general assumption that ODBC connections kill database performance. Microsoft plans to deliver a set of highly optimized ODBC drivers with the Enterprise edition that will bypass Jet completely to allow direct access to standard SQL servers. Microsoft claims that these drivers will give performance competitive with PowerBuilder's native drivers.

VB 4.0 will improve on the data controls

pabilities and modify the behavior of a VBX using Delphi through subclassing. The Delphi Client/Server package includes the complete source code for all of the Visual Component Library components. As an extensible architecture, Delphi is first-rate.

DATA ENGINES

Both Delphi and VB provide robust data-access capabilities through proprietary database engines that help abstract the developer from the back-end data sources and present uniform record-navigation methods.

VB 3.0 comes with the same Jet engine used in the powerful Microsoft Access database. Since it shipped before Access 2.0, however, VB 3.0's Access 1.1 engine is not the latest version. A VB Compatibility Layer gives you the ability to work against Jet 2.0 databases, however.

Our testing showed that it's a good idea to have Access 2.0 and VB on the same machine, when you're working on database applications. In addition to the updated engine, Access gives you much better control over your database than VB's rudimentary Data Manager utility. Jet stores all of the elements of a database as a single .MDB file and allows you to attach tables in the .MDB file to remote data tables. VB and Jet together let you access ODBC SQL databases, as well as Access, Btrieve, dBASE, Microsoft FoxPro, and Paradox data directly. One of the most powerful features of Jet is its ability to perform heterogeneous joins against different databases (say, Microsoft SQL Server and dBASE),and give you a unified, updateable view of that data.

There are two ways to work with databases in VB: through bound data controls and programmatically through Access's Data Access Objects (DAO). Data controls provide the easiest solution. You simply place the data control on the form and set its DatabaseName and RecordSource properties to point to the database table or tables you wish to access. You can then use the data control as the record source for data-bound controls.

Unfortunately, only some of the editing controls in VB 3.0 are data-bound controls. The lack of data-control support for important controls such as the combo box and grid have spurred a number of third-party custom-control developers to fill the gap. The data control returns a *dynaset*, a dynamically updateable view of the underlying data. You have much more control, however, if you use the DAO support in the VB Professional Edition. This lets you work directly with tables and queries in code and gives you more flexibility in returning and navigating the data. You can also reap some performance gains by implementing Jet transactions through code to batch updates, since a dynaset will normally update the database one record at a time.

Delphi Client/Server comes well equipped for database-oriented application development. Delphi uses the Borland Database En-

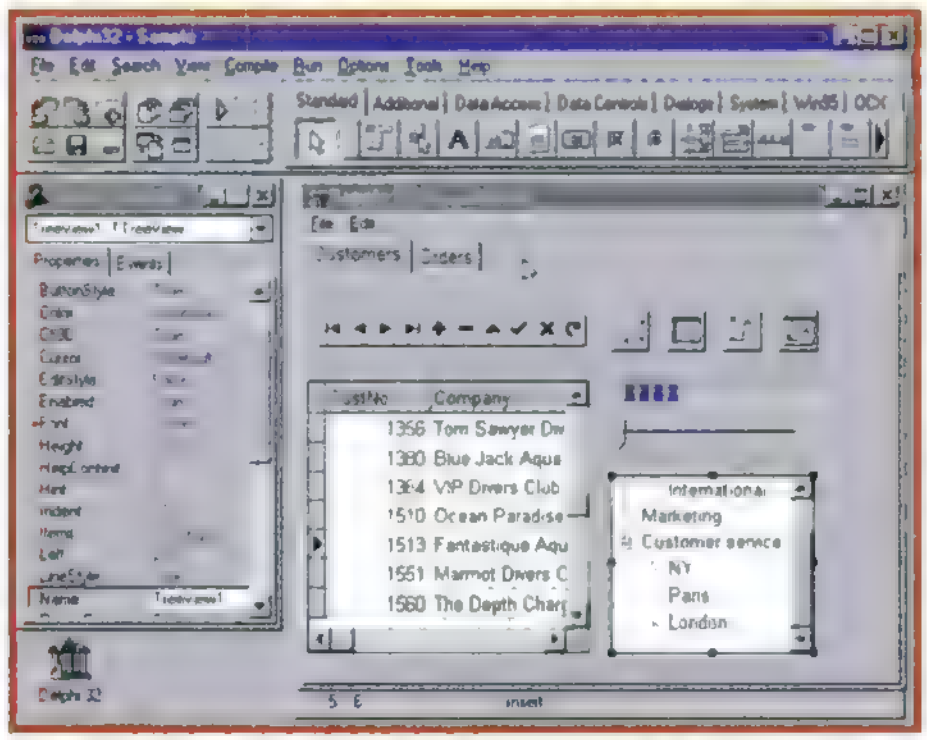
as well. The new data controls will support new events that fire as you leave each end of a record set, a feature that would have saved us considerable time during our tests. You will also be able to bind data controls to Jet snapshot and table objects; currently, you can only link data controls with dynasets. In addition, Microsoft plans to make its grid, list box, combo box, and OLE controls data-aware, filling a gaping hole in the current version.

Microsoft's OLE plans go way beyond the introduction of the new OLE-based custom-control standard. A key element of the new Enterprise Edition will be a distributed-object technology based on an OLE mechanism. This will enable the distribution of application components across a network—for example, as separate user, business rule, and data services. There are several advantages to such a multitier approach: Applications will be able to off-load computationally intensive tasks to more powerful systems on a network, and business rules will be easier to update since they will be logically separate from the UI and database. This ambitious scheme, which offers an intriguing new approach to multitier application development, anticipates the distributed OLE model slated for Microsoft's Cairo, the company's planned successor to Windows NT due next year.

AN EVEN-NEWER DELPHI

Though Delphi is still a new product, Borland is working furiously to turn out a newer 32-bit version by the end of this year.

Like VB 4.0, the new Delphi will be hosted on 32-bit Windows platforms and will enable 32-bit application development. Apparently, Borland will continue shipping a separate 16-bit Delphi product as well, although the company will ensure that this version will also run under Windows 95 and Windows NT as a 16-bit app. Priority number one for the Delphi team is code compatibility. Your existing Delphi code should merely need recompilation to become a 32-bit application. Borland is considering adding code support for multithreaded applications, however. If this happens, you may want to consider some changes to the architecture of your existing apps.



The 32-bit release of Delphi will support a full range of Windows 95 interface objects.

The new Delphi will support the new Windows 95 components, including notebook tabs, progress bars, a rich-text editor, a tree view, header controls, and up and down controls. It will also support VB 4.0's new OCX controls and let you subclass these in your own components. Though Borland could not make a definitive statement as we went to press, the ability to create OCX controls within Delphi is clearly high on its wish list. Like VB, Delphi will also gain a 32-bit local database engine. The new 32-bit BDE will be ANSI SQL 92–compliant; new 32-bit SQL Links should boost performance considerably.

Borland also plans to add a new 32-bit compiler back end to Delphi, the same one used in the company's C++ compiler product. In addition to your ability to create .EXEs and .DLL files, the new Delphi will let you work with the same .OBJ file format used by Borland C++. This will make Delphi an even more powerful tool for coders of developer libraries. Borland is claiming even better compiler performance with a new back end.

Delphi is also slated to receive OLE automation functionality. The new version will not only let you drive other OLE applications, but it will support the creation of OLE automation objects that expose your own methods. These methods will be accessible from other OLE-enabled applications.

While they remain different in many fundamental ways, Delphi and VB are clearly pointing at the same 32-bit target. It's up to developers to decide which one has the better aim.

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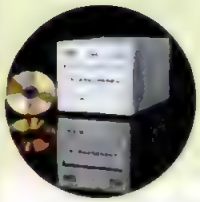

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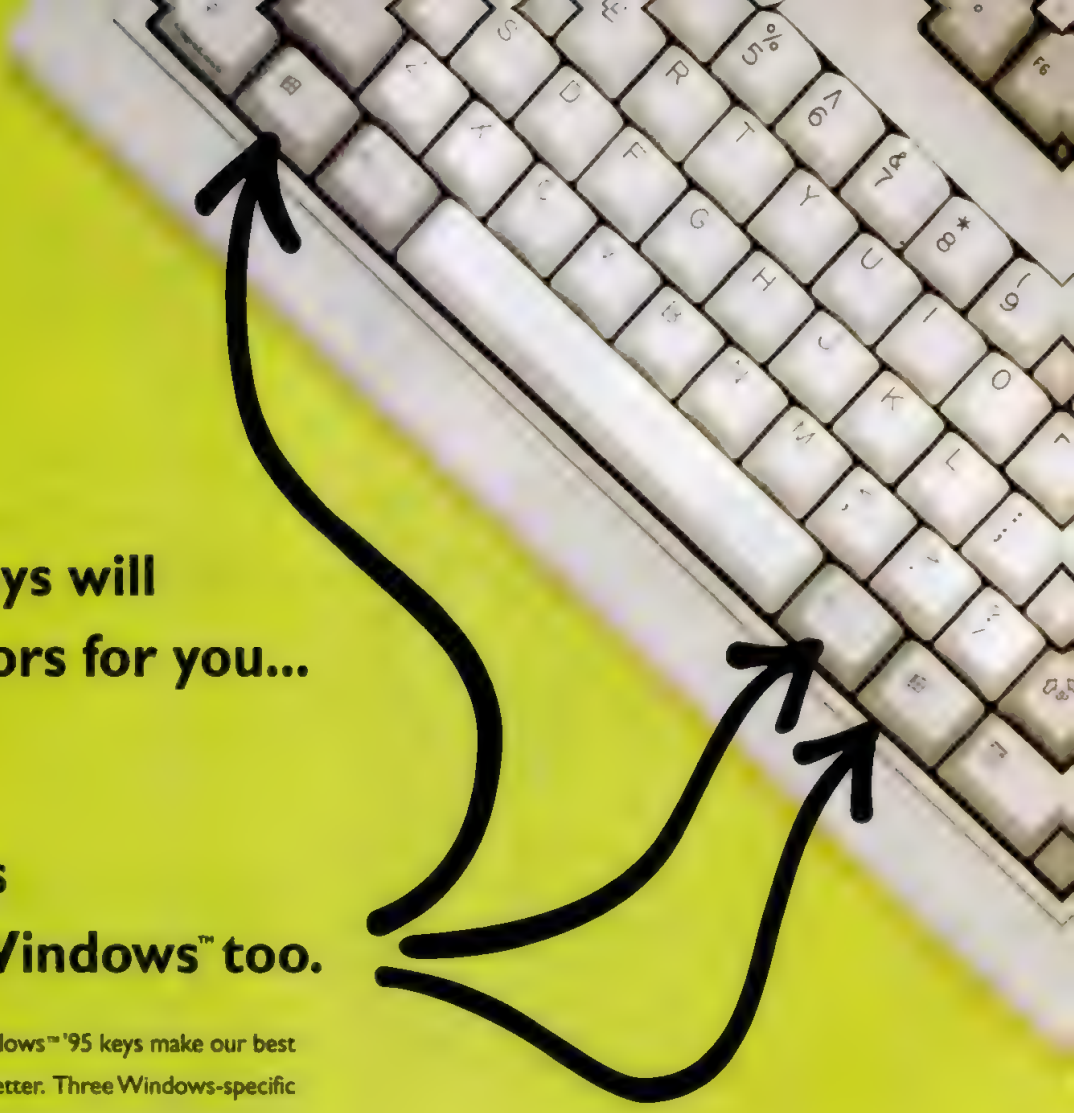

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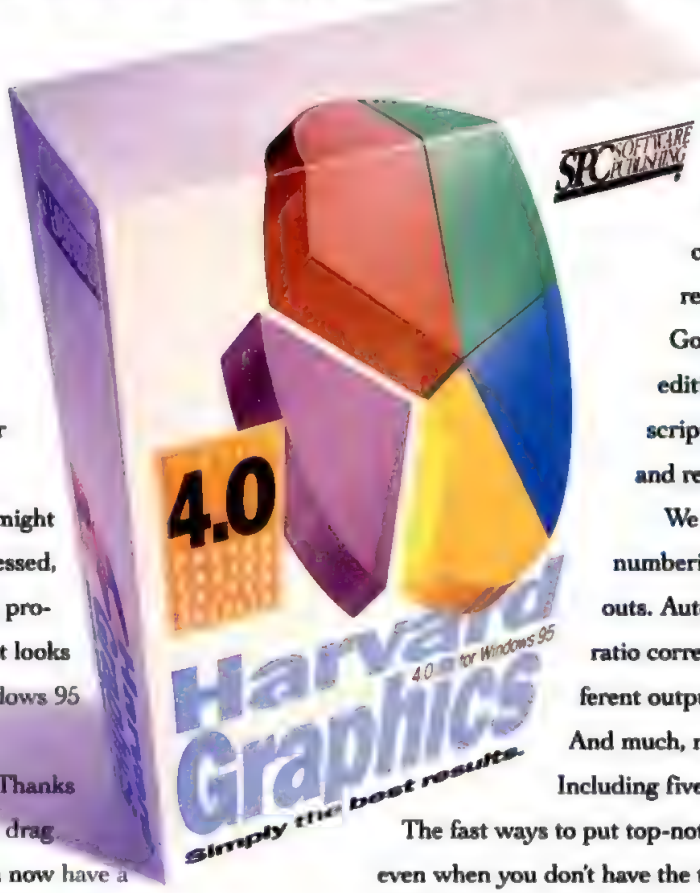

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CIRCLE 221 ON READER SERVICE CARD

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gine (BDE), the underlying engine used in both Borland's Paradox and dBASE and the cornerstone of all Borland PC database products. BDE is a centralized data engine similar in concept to Jet. It can work directly with dBASE and Paradox files, and—through Borland SQL Links—can access Informix, InterBase, Microsoft SQL Server, Oracle, and Sybase. BDE also supports ODBC drivers, though it comes with none of its own. Borland SQL Links are optimized drivers that offer high-performance connectivity and let you take advantage of server-specific features. Delphi also comes with the Local InterBase Server, a fully functional Windows version of The Borland InterBase Workgroup Server. This local engine can be used to develop applications for deployment later against remote SQL databases. It can also be distributed royalty-free with applications built with the client/server version.

Although BDE abstracts your data source and provides consistent cursor management much as Jet does, it deals differently with its data. When Jet performs a query for a dynaset, it initially returns only the keys for the result set. Then, in the background, or as requested, Jet retrieves the actual data for the dynaset. The user perceives a fast response time, even with huge return sets. BDE, on the other hand, will return all of the rows of a query to a local result set automatically.

> While both tools fulfilled the requirements of our test application, Delphi particularly impressed us with its broad database functionality.

Delphi includes two types of components for database access, one nonvisual and one visual. The nonvisual components, which provide the actual low-level links to your database, are located on the Data Access page of Component Palette.

Unlike VB, Delphi implements these low-level links using two layers of nonvisual components in order to provide a database abstraction before linking to visual components. The lower layer comprises two components, TTable and TQuery, which provide the link to BDE and its data sources. You can choose to use either or both depending on your form's needs. For each TTable or TQuery component on a form, you can attach one or more upper-layer TDataSource components. These serve as the link to all of your visual database components. Two other powerful upper-layer nonvisual components, TStoredProc and TBatchMove, offer the integrated capabilities to execute stored procedures on a server and perform batch copy operations between tables or even disparate databases.

On the Data Controls page, you will find Delphi's 12 visual data-bound controls, which let you build a user interface to your database. Delphi provides a broad range of components here including a bound grid, a navigator component for performing basic cursor navigation and editing operations, bound labels, bound edit boxes, and bound radio-button groups. The DBMemo and DBImage components allow you to edit binary large object (BLOB) text and graphic data.

Two other components, the DBLookupList and DBLookupCombo, give you easy ways to present your users with scrollable lists of predetermined choices and to update database fields automatically with valid values. The list presented to the user can come from a different data source than the data source being updated. For example, an invoice-entry screen might present the user with a drop-down list of company names and phone numbers and upon selection update an invoice table with the correct customer ID. The user never has to worry about the customer ID and you don't need to worry about checking for valid entry. Overall, Delphi offers a good selection of data components that are on par with third-party packages available for VB, and you are always free to whip up your own by modifying the standard components.

Like VB, Delphi lets you use SQL pass-through to talk directly to a SQL database without any BDE translation. While this does require more knowledge of your server's capabilities, it lets you take advantage of server-specific functions. One key advantage of using one local database engine to address multiple back ends is flexibility. Since Jet lets you create customizable attachments from Jet tables to remote data sources, and BDE lets you abstract data sources with aliases, you can build an application on one database and scale the application later to another database relatively easily.

PUT TO THE TEST

During testing at PC Labs, we built a section of a realistic database application that implemented a one-to-many order-entry screen. Our entry screen was rather ambitious and required access to five separate database tables. Our test script also required the creation of validation logic and implementation of referential integrity constraints. For both development systems, we first worked on local data in the tool's native database format and then switched the connection to an identical database schema running on Microsoft

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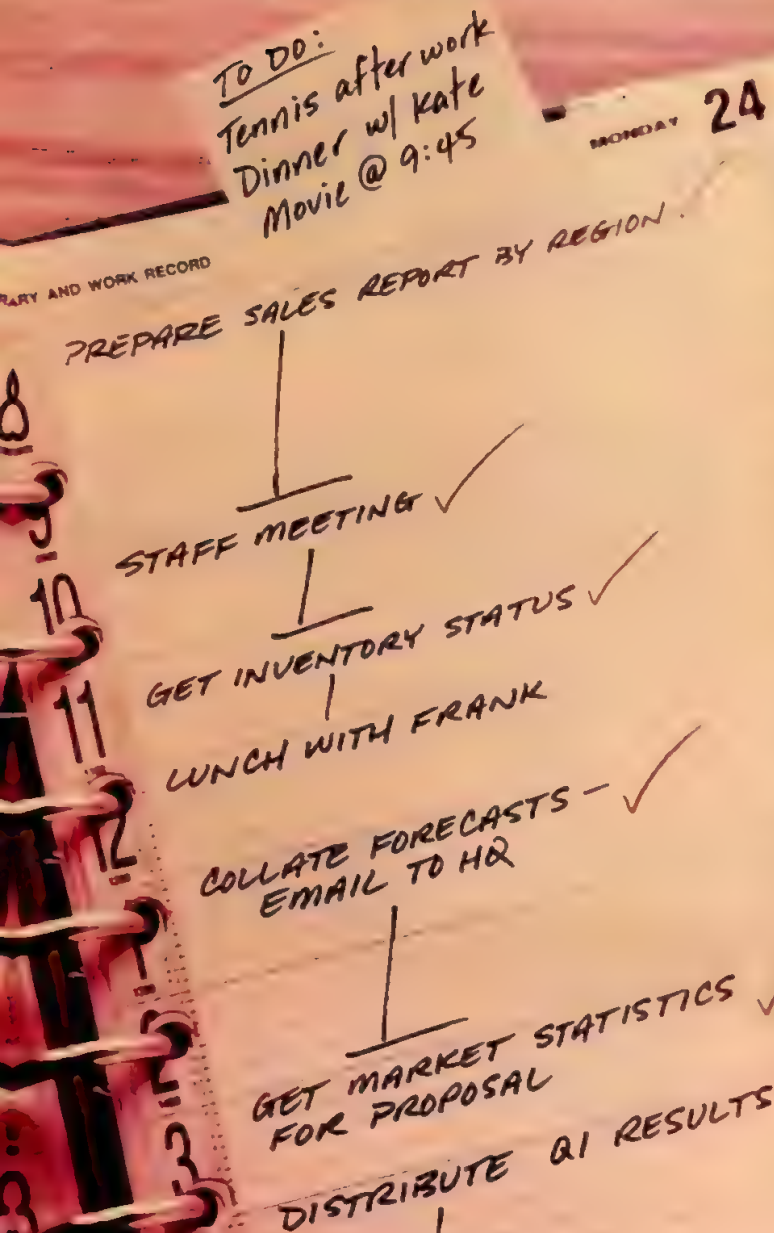

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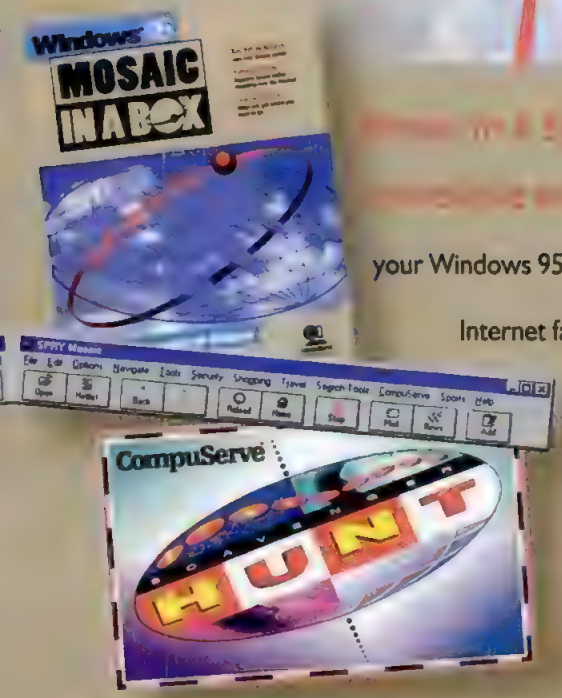

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FACT #1:

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FACT #2:

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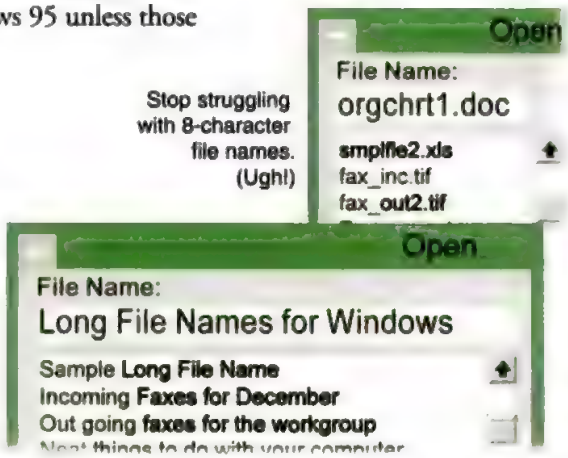

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SQL Server, Version 4.21. While both tools fulfilled the requirements of our test application, Delphi particularly impressed us with its broad database functionality, which required only minimal hand coding.

Delphi got us off and running quickly with its Database Form Expert, which stepped us quickly through the process of building a one-to-many form based on our first two tables. The Database Form Expert creates the form, adds edit boxes for the fields of the primary table and a data grid for the secondary table, places the TTable and TDatasource components on the form and adds a Navigator component. From there, we simply added three more TTables and TDatasources for access to our Salesman, Order_items, and Products tables to get the data we needed. We ended up with two navigator components, one for browsing customers and another for orders; and a TQuery component that we used for adding orders.

For the tests with VB, we allowed Microsoft to use a set of third-party tools from Sheridan Software Systems: Datawidgets 1.0d, Designer Widgets 1.0b, and VBAssist 3.5a. These three add-in products list for a total of $349. Microsoft also used Access 2.0 to work with the database during the design process and to create SQL query statements visually. Access retails for $339.

Though this collection of tools gave us all the functionality we needed for our test application, we spent a considerable amount of time debugging it. The problem turned out to be related to some of the inherent limitations in the VB data control. One of its quirks is its behavior as you access the end of its record set from within code. Although the problem had nothing to do with the Sheridan controls, it took us a while to isolate the problem since we had a mixture of standard and third-party controls. In the end, our application performed flawlessly. Although the VB application required only slightly more hand coding than the Delphi application, we found that the code was less readable since it was hidden behind various controls in their event handlers.

While Delphi and VB are well suited to RAD, there is no question that Delphi has one-upped VB in power. Delphi's power, however, comes at a price: Delphi Client/Server lists for $1,995. In contrast, Visual Basic, Professional Edition, lists for only $339, leaving plenty in your budget for the third-party controls you're likely to need. Much of Delphi's high price tag is because of the unlimited distribution license for the Local InterBase Server you get with Delphi Client/Server. From a visual design perspective, Delphi comes in about even with VB when VB is coupled with third-party custom controls and environment enhancements.

When it comes to coding, however, it's a different ball game. Delphi's Object Pascal gives you top-notch power for a language that is closely integrated with visual design tools. OOP, however, is certainly not for everyone, and VB makes coding a simple task for just about anybody.

SUMMING UP

For the professional who writes general-purpose applications, Delphi is superior to VB on many fronts and offers a highly viable alternative to such languages as C++. Hobbyist programmers are probably better served by VB unless they are seriously committed to learning OOP.

For corporate client/server developers—a market both Borland and Microsoft see as critical for success—the choice is more complex. Clearly, both tools are up to the task of building a wide range of client/server applications. Other factors you should consider include the current skill levels and language backgrounds of your programmers, your company's willingness to adopt an object-based code-reuse strategy, the performance requirements of the application, and the type of SQL back ends you'll be developing against. Corporations should also clearly examine any prospective tool vendor's long-term strength and stability as a business before standardizing on its products.

Within two years, we predict that the combination of visual development, object-oriented language, and incremental compiler as pioneered by Delphi will become as common as visual programming is today. While companies may feel uneasy about making the move right now, many will be considering pilot programs in the near future. Certainly, a company that is not using visual RAD tools such as VB, Delphi, or one of their competitors is missing out on this decade's biggest trend in software development. □

Delphi Client/Server. *List price: $1,999.95. Includes: Borland Database Engine, SQL Links for Informix, InterBase, Microsoft SQL Server, Oracle, and Sybase SQL Server; ReportSmith 2.5 and ReportSmith SQL drivers; Local InterBase Server with unlimited deployment license; WinSpector resource editor and WinSight message spy tool; Visual Component Library source code. Recommended development platform: 486-based PC or better, Microsoft Windows 3.1, 8MB RAM minimum.*
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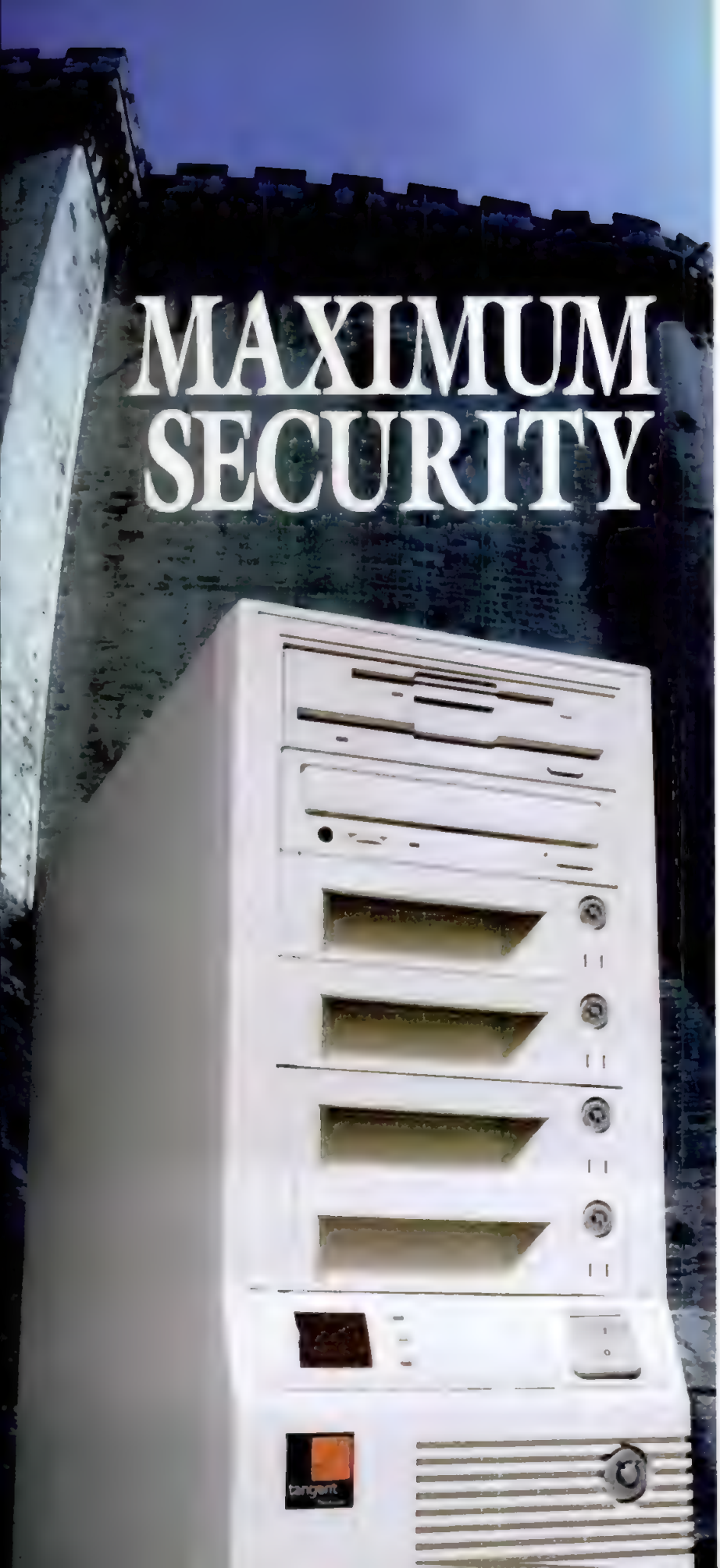

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CIRCLE 282 ON READER SERVICE CARD

By Jeff Prosise

Tapping the Power of the Windows 95 Shell

Once you become familiar with the new user interface, Windows 3.1 will seem archaic.

So you've finally loaded Windows 95 on your PC and brought it up for the first time. Now what? Immediately, you're confronted with a user interface that is vastly different from that of Windows 3.1, and your old friends File Manager and Program Manager are gone. What you see on the screen before you is the Windows 95 shell—the program that creates the desktop and forms the basis for the Windows 95 user interface.

Unlike its counterpart in Windows 3.1, the Windows 95 desktop shell is a powerful and highly extensible part of the operating system. There are numerous ways to customize it and use its built-in features to make working in Windows easier, but many of these features aren't obvious. Like any new user interface, this one will take a little time to get used to. Once you grow familiar with it, you'll find it has all sorts of capabilities that you didn't know existed. Pretty soon most users find that the Windows 3.1 interface seems archaic in comparison.

Of course, the shell will do you little good until you learn to use it. Here are a few tips to get you started tapping the power of the Windows 95 shell.

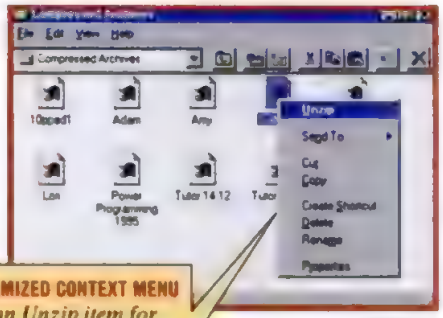
WINDOWS 95 *lets you create a shortcut icon on the desktop simply by dragging a program's icon from its folder onto the desktop.*

FIGURE 1

USE SHORTCUTS FOR QUICK ACCESS

Windows 3.1 spawned a variety of quick-start utilities designed to provide quick access to programs you use often. Windows 95's Start menu makes it a little bit easier to get to your application programs, but the Start menu makes it no easier to start a program you use every day than to start one you use once or twice a year.

You can remedy this by using *shortcuts*, or links on the desktop that stand in for shell objects. Suppose you would like to have immediate access to Word for Windows, without having to go through the Start menu and its various submenus. Here's how to do it. Double-click the My Computer icon (or right-click it once and select Open) and find your way to the folder that contains WINWORD.EXE. Then drag its icon out of the folder and onto the desktop. You just created a shortcut to WinWord (see Figure 1). Next time you want to start Word, just look to the desktop and double-click the icon labeled Shortcut to Winword. Use the same method to create shortcuts for all the applications that you use on a regular basis, and you'll have your own customized desktop.



CUSTOMIZED CONTEXT MENU *with an Unzip item for .ZIP files.*

FIGURE 2

Shortcuts are efficient because they require very little memory and disk space. And they are persistent: They're stored on disk as .LNK files and re-created each time the shell is started, so they will still be there the next time you start Windows. And they are not only for application programs. They also work with documents, folders, drive icons, printer icons, and virtually any other object that you see on the screen. If you wish to build a Macintosh-like desktop that contains icons for all your drives, open My Computer and create a shortcut for each drive. Among other things, this provides a ready-made set of drop targets for moving and copying files using drag-and-drop. And when you want to format a floppy disk in drive A:, just insert the disk, right-click the shortcut to drive A:, and choose Format from the context menu. You'll no longer have to worry about cryptic command line switches, because all the formatting options are laid out for you in a dialog box. Create desktop shortcuts for your printers, and you'll find that they make great drop targets too.

If you would like to change the title of a shortcut icon (or any other shell object), just click the icon, click the text underneath it, and enter the new title. You can change Shortcut to Winword to Word for Windows or whatever you like. Shortcuts are always identifiable by the curly arrow in the lower-left corner.

WHEN IN DOUBT, RIGHT-CLICK

One of the Windows 95 shell's most powerful features is the context menu it displays when you click an object with the right mouse button. Context menus provide a concise list of everything you can do to an item displayed by the shell. See something on the screen and wonder what you can do with it? Right-click and see what the context menu says; you'll never go wrong. The menu item that is highlighted in boldface type (usually Open) is the default action that is invoked if you double-click the object with the left mouse button. For a document

object, Open calls up the application that created the document and automatically loads the document for editing.

The Properties item found in nearly every context menu is your key to configuring the objects displayed by the shell. To switch screen resolutions in Windows 3.1, you had to start Windows Setup and select a new video driver. Often, it was anybody's guess which video driver to use, because the driver's name did not necessarily spell out the video resolution. In Windows 95, you can do the same thing by right-clicking the desktop, selecting Properties, clicking the Settings tab in the property sheet, and setting the trackbar to the desired resolution. In other words, the screen now behaves as an object whose properties can be set just as easily as any other object's. This new way of doing things is used throughout Windows 95. Rather than using a PIF editor to set the properties of a DOS application, for example, you may now right-click the file icon, choose Properties, and make your entries in the property sheet. This is superior by any measure to the old way of configuring DOS apps.

Right-click around and you'll find that the shell recognizes many object types and adapts the context menus accordingly. One of the options in the context menu for a drive object, for example, is Format. Right-click a .REG file document object (which contains registration data for an application program) and you'll see a Merge menu item for merging the contents of the file into Windows 95's registration database. Applications can add their own items to context menus, so you never know what you'll find.

CUSTOMIZE CONTEXT MENUS

You can easily tailor context menus to meet your individual needs. Suppose you use PKZIP a lot, and you would like to have an Unzip option added to the context menus of .ZIP files so that you can unzip files without having to open a DOS window and type commands.

No problem. Here's how to go about it. First, fire up your favorite text editor and create a file named ZIPFILE.REG composed of the following statements:

```
REGEDIT
HKEY_CLASSES_ROOT\.zip = ZipFile
HKEY_CLASSES_ROOT\ZipFile=PKZIP
➥Archive
HKEY_CLASSES_ROOT\ZipFile\Shell\
➥Unzip = &Unzip
HKEY_CLASSES_ROOT\ZipFile\Shell\
➥Unzip\Command = c:\util\
➥pkunzip.exe %1
```

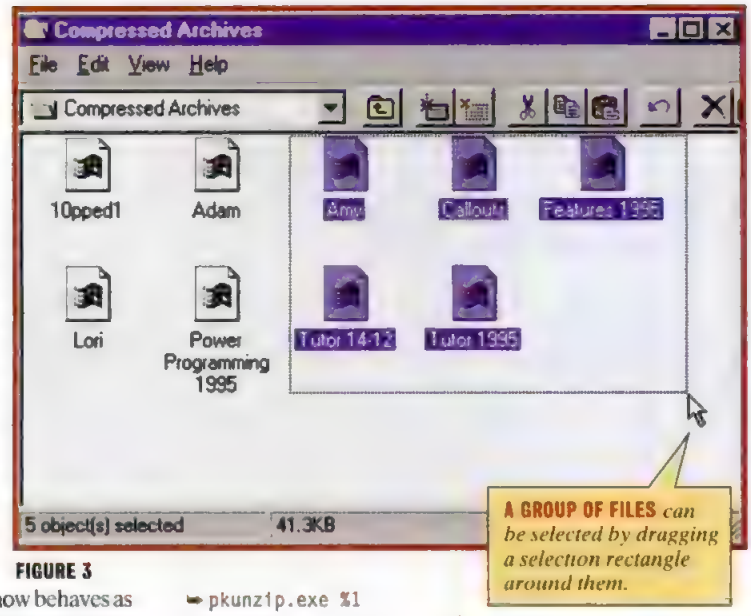


FIGURE 3

The path I used in this example—C:\UTIL\PKUNZIP.EXE—happens to be where PKUNZIP is located on my PC. Be sure you modify this line with the proper path to PKUNZIP on your PC. Next, right-click the ZIPFILE icon and select Merge to merge its contents into the system registry.

The next time you want to unzip a file, go to the folder in which it is stored and right-click the file icon to bring up its context menu, which now contains an Unzip choice (Figure 2). When you click this choice, the shell will open a DOS window and run PKUNZIP for you, automatically passing the filename. When unzipping is complete, click the close button in the upper-right corner of the DOS window. The window will go away and the files extracted from the archive will now appear in the folder.

What if you want to unzip several files at once? Group-select them by clicking all those after the first with the Ctrl key held down, or by holding down the left mouse button and dragging a selection rectangle around them, as shown in Figure 3. Then right-click any one of the highlighted icons and choose Unzip, and all the selected files—not just the one you clicked—will be unzipped. Group-selecting is also handy when you are cleaning out a folder by deleting unneeded files. Instead of deleting them one at a time, select all the ones you wish to delete and press the Del key to delete them as a group.

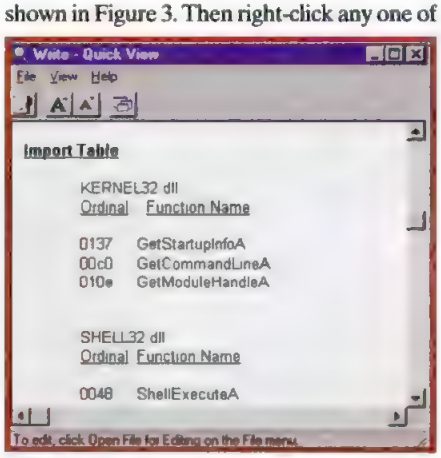


FIGURE 4: *This Quick View list shows all of the DLLs imported by the Write accessory.*

USING QUICK VIEW TO VIEW DOCUMENTS

How many times have you wanted to look at a file on a floppy disk and found you didn't have the application you needed to view it? Maybe it was an Excel file and you didn't have Excel. In previous versions of Windows, a data file was just about useless without the application that created it.

Not so in Windows 95. The Quick View item found in many context menus provides an easy and application-independent way of seeing what's inside a data file. Windows 95 provides file viewers for about 35 different file types, including .BMP, Excel, .GIF, Lotus 1-2-3, PowerPoint, Word, .TIF, and even encapsulated PostScript (.EPS) files. Quick View is optional and may not be installed on your PC if you chose Typical rather than Custom when setting up Windows 95. You can always add it after the fact by choosing Settings | Control Panel from the start menu, opening Add/Remove Programs, clicking the Windows Setup tab in the ensuing property sheet, double-clicking Accessories, checking the Quick View box, and clicking OK a few times.

The Quick View interface is open and documented, so application vendors and third-party utility makers can write additional viewers to supplement the ones provided with the operating system. Having a file viewer is never quite as good as having the full-blown application—you can't edit a document with a file viewer, for example, and a lot of the formatting gets thrown out the door—but at least you can see the document's *content*.

One of the neat things that you can do with the built-in file viewers is to determine what DLLs an .EXE file implicitly loads. (An implicitly loaded DLL is one that contains functions a program relies upon and that is loaded automatically when the program starts.) If you read *PC Magazine*'s Tutor column of April 11, 1995, you may remember ExeProp, the utility program that adds a Dependencies page to the property sheets of Win32 executables listing the DLLs that the program uses. You can do the same thing with Quick View. To demonstrate, go to a folder that contains an .EXE file, right-

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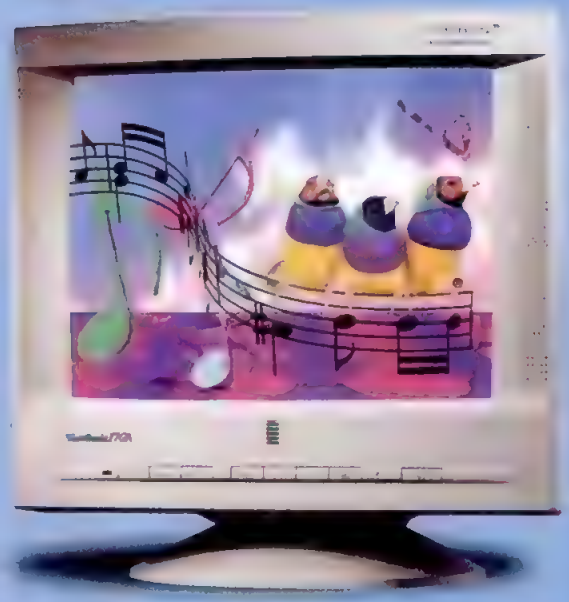

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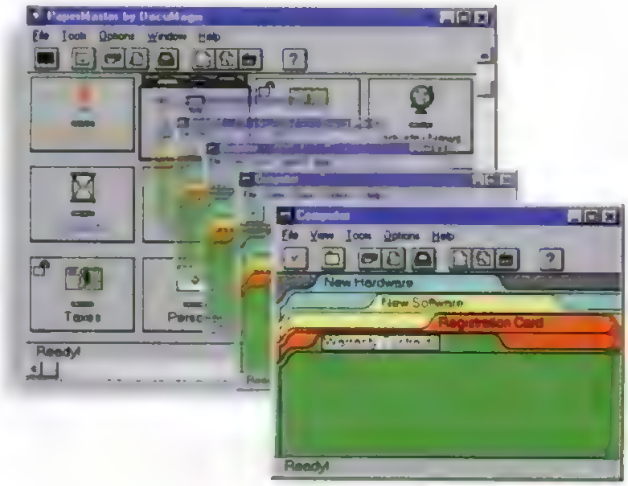

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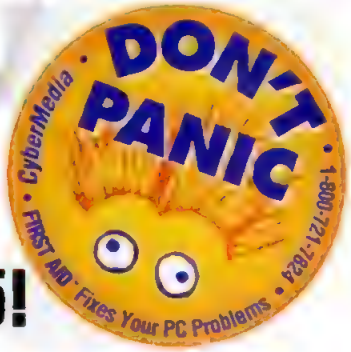

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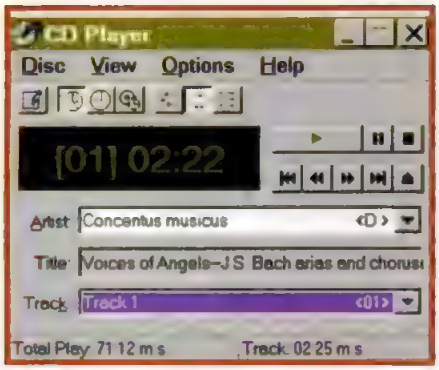

FIGURE 5: *The CD Player applet pops up whenever you insert an audio CD into your CD-ROM drive.*

click the file, and choose Quick View from the context menu. Then scroll down through the output until you see a line that says Import Table or Imported-Name Table in bold type, as shown in Figure 4. Underneath, you'll find a list of the DLLs that the program imports (for example, KERNEL32.DLL) and for 32-bit executables only, the names of the functions inside the DLLs that the program uses.

A TREASURE TROVE OF RICHES

Click around in the Windows 95 shell and you'll find lots of other buried goodies. Here are just a few examples:

- Insert an audio CD into your CD-ROM drive. Then open My Computer and right-click the CD-ROM drive icon. Choose Play to play the compact disk or use the CD Player applet that is started automatically (and whose icon will appear in the Taskbar) to choose a particular track (Figure 5).
- If you don't like the Taskbar's default location at the bottom of your screen, drag it with the left mouse button to the top, left, or right side of the screen. If a vertical Taskbar makes icon labels difficult to read, widen the Taskbar by dragging its border. Or move the mouse pointer over the icon whose title you wish to read and pause for half a second; the full title will appear in a tooltip window.
- ToolTips—miniature windows that display hints for controls such as buttons and toolbars—are used throughout the shell. Find today's date quickly by placing the mouse pointer over the time clock that appears in the corner of the Taskbar. After a brief pause, the date will appear in a ToolTip window.
- Want to create a new Word document on the desktop? Rather than starting Word, right-click the desktop, choose New, and choose Word Document from the cascade menu. Then type the document title and open the document.
- If you're looking for a particular document and don't remember what you called it but *do* remember a word or phrase in it, you can perform a diskwide text search by selecting Find from the drive's context menu, clicking the Advanced tab, and entering the word or phrase in the Containing text field (Figure 6). The shell will display the names of all files that contain the specified text.

These are just a few of the nuggets you'll find when you go exploring in the Windows 95 shell. Rest assured there are plenty more. □

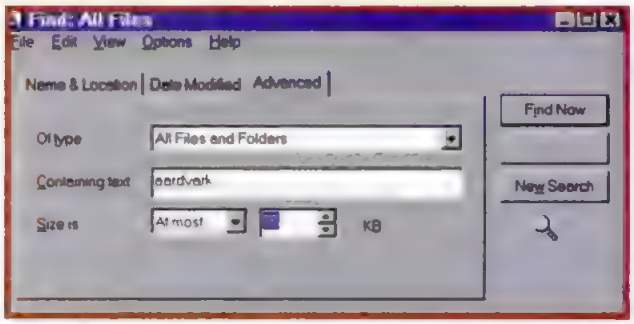

FIGURE 6: *You can perform a diskwide text search by selecting Find from a drive's context menu, clicking the Advanced tab, and entering a word or phrase in the Containing text field.*

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CIRCLE 112 ON READER SERVICE CARD

How PC Direct Helped Computer Discount Wa Found "Customer Univ

All the employees at the Computer Discount Warehouse are still in school. No, they're not teenagers anymore, but they're all enrolled in a program called CDW University — which they also call "Customer U."

"We believe that the only way to grow is to make the customer #1," says Michael Krasny, the company's CEO. "That's why we established an on-going, mandatory training program that focuses on customer service and product briefings. Our employees also have personal, hands-on experience of a lot of the products they sell — and they know how to treat the customer right."

The customer support program at CDW, a ten-year-old reseller of PC hardware and software, includes free technical support from 8 a.m. to 7:30 p.m. "We guarantee that support calls will be answered within three minutes," says Krasny. He also points out that a $10 million product inventory makes it possible for the company to provide same-day order shipment.

Computer Discount Warehouse has turned their success into an opportunity to offer better customer service, and Krasny singles out his advertising in PC Magazine as the cornerstone of his success. "We've been in the PC Direct section since 1986, and we've never missed an issue. Our most loyal customers, the ones who appreciate service, come to us through PC Magazine. No matter how you look at it — closing rate, calls per ad dollar — PC Magazine is tops."

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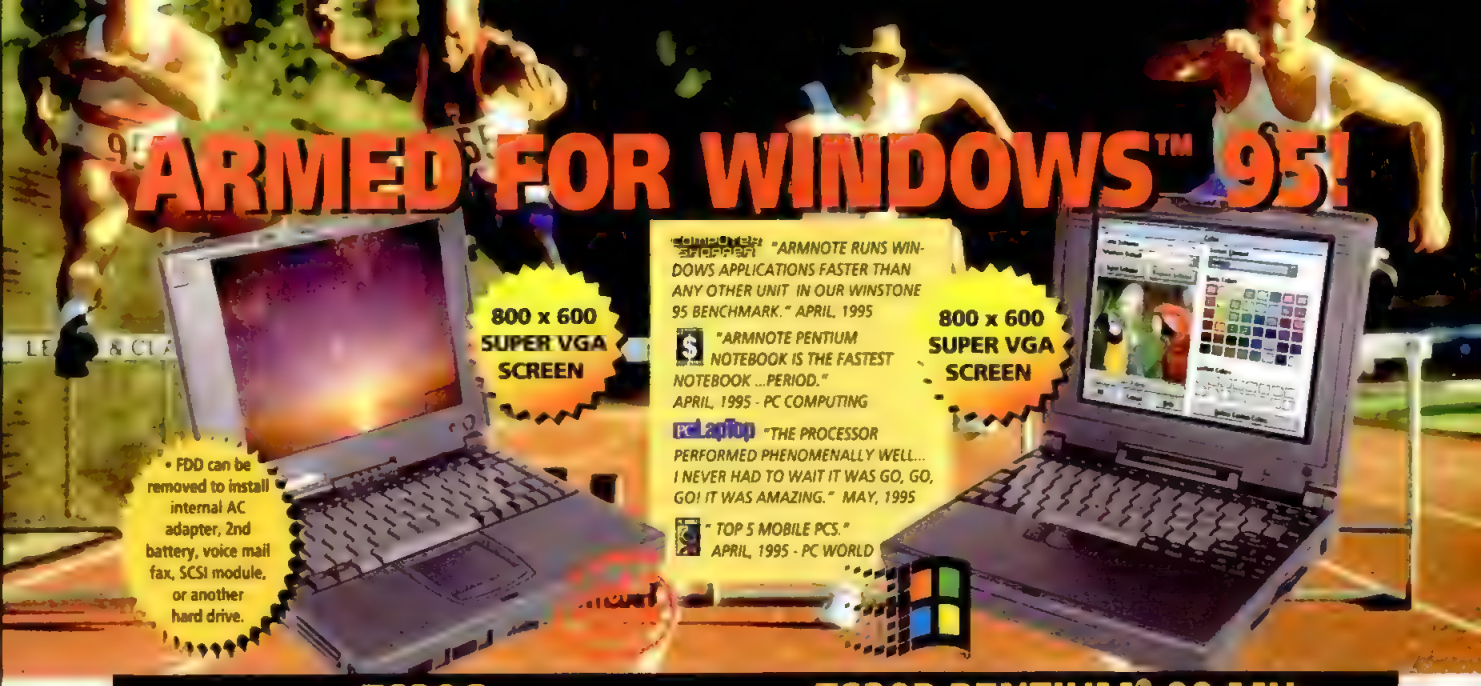

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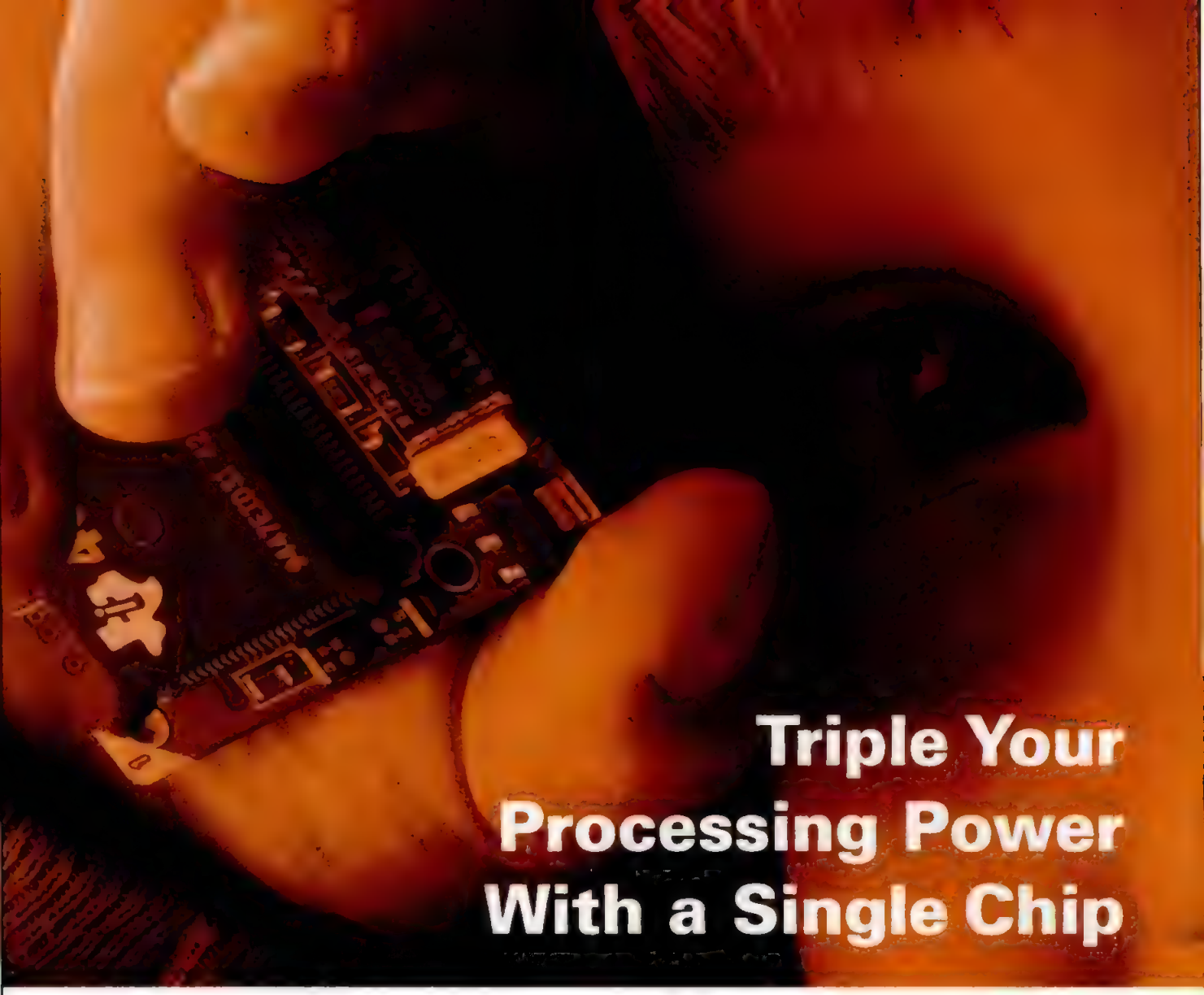

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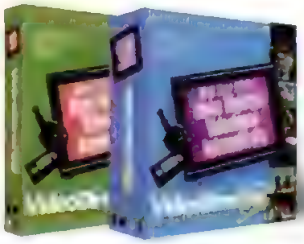

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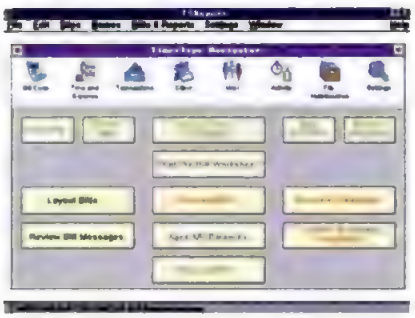

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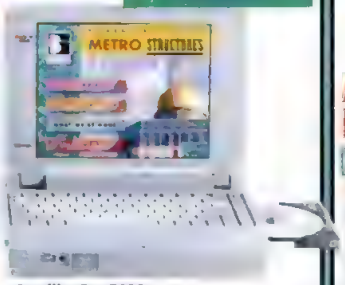

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CIRCLE 092 ON READER SERVICE CARD

By Jim Mischel and Pete Davis

Undocumented WinHelp, Part 2

Find out how to make WinHelp do things it really wasn't meant to do.

In the July Power Programming column, we talked about a variety of undocumented aspects of WinHelp. In this installment, we'll discuss more of these and, using some undocumented Windows features, we'll make WinHelp do some things it wasn't really meant to do.

First you'll learn about using the Windows API from WinHelp. This isn't exactly undocumented, but the SDK doesn't make it clear why or how you can utilize this ability. Next you'll learn how to get into WinHelp from the outside. Ever want to add functionality to WinHelp, even for help files you didn't author? We'll show you how to "hook in."

Before we start, there are two caveats you need to be aware of. First, the techniques we discuss will either change or become unavailable in Win32 versions of WinHelp, including Windows 95; second, as with any discussion of undocumented features, you can't count on their being present in any future releases. For a brief synopsis of WinHelp 4.0—the version that will ship with Windows 95—see the sidebar "What's New in WinHelp 4.0."

USING THE WINDOWS API FROM WINHELP

Most WinHelp developers know they can write DLLs that can be accessed from a help file, but it's also possible to use the Windows API from within a help project file or from help topic files without supplying your own DLL. Just register routines from the Windows DLLs containing the API calls. For example, if you want to use the SetWindowLong() function, you simply need to register the routine with the RegisterRoutine() function and then call it as you'd call any macro. The RegisterRoutine() function has the following syntax:

```
RegisterRoutine(dllname,
➡functionname, parameters)
```

The parameters to RegisterRoutine() are

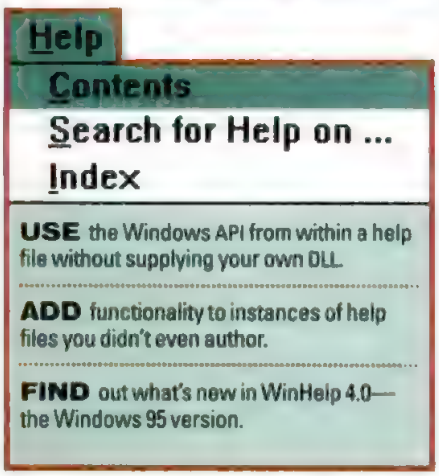
- *dllname*—the DLL containing the routine you want to register;
- *functionname*—the function you want to register;
- *parameters*—a string with one character to represent each parameter in the function you are registering. Valid characters are `u`, an unsigned short integer; `U`, an unsigned long integer; `i`, a signed short integer; `I`, a signed long integer; and `S`, a far (32-bit) null-terminated string pointer. A letter preceding an = sign defines the return value type (`u=` means that an unsigned short integer is returned).

The following registers the SetWindowLong() routine:

```
RegisterRoutine("user.exe",
➡"SetWindowLong", "uiU")
```

There are, however, some serious limitations on using API calls. Since you can't create variables in the help project file or RTF file, you can't store return values from functions. With some creative embedding of functions, though, you can use return values from API functions. The following example can be added to the [CONFIG] section of your help project file to disable the File | Print Topic menu item in WinHelp:

```
RegisterRoutine("user.exe",
➡"EnableMenuItem", "uuu")
RegisterRoutine("user.exe",
➡"GetSubMenu", "u=ui")
RegisterRoutine("user.exe",
➡"GetMenu", "u=u")
RegisterRoutine("user.exe",
➡"GetActiveWindow", "u=")
EnableMenuItem(GetSubMenu(GetMenu
➡(GetActiveWindow()), 0), 2, 1027)
```



You can actually disable any menu items you want, or reenable them. A good use for this would be to disallow printing and clipboard copying during certain topics that contain "sensitive" information (although a screenshot would still be possible). The core of this is the EnableMenuItem() function call. The `0` is a parameter to the GetSubMenu() function and tells EnableMenuItem() which menu you're working with. The following are its values when used with WinHelp:

```
0=File
1=Edit
2=Bookmark
3=Help
```

The `2` is the zero-based index of the menu item in the menu that you're working with. Separators count, so the number for Print Topic is 2.

The 1027 is the *action flag* for the menu item. The following values are useful:

```
1024=enabled
1025=grayed
1026=disabled
1027=grayed and disabled
```

Want to disable the system menu, minimize, and maximize buttons? It's easy. Just add the following to your .HPJ:

```
RegisterRoutine("user.exe",
➡"SetWindowLong","uiU")
RegisterRoutine("user.exe",
➡"SetWindowPos","uuiiiiu")
SetWindowLong(hwndContext,-16,
➡0x16000000)
SetWindowPos(hwndContext,0,0,0,0,0,
  0x27)
```

In the SetWindowLong() function, we're setting the style (GWL_STYLE = -16). The style we're giving it is WS_VISIBLE | WS_CLIPSIBLINGS | WS_CLIPCHILDREN. Finally, we make a call to SetWindowPos() so that these changes can take effect. We pass 0 for the *hwndInsertAfter* and all the *x* and *y* coordinates for the window. We don't actually want to change the position or the *z*-order, we just want to redraw the frame. The 27h is the sum of the following bit flags: SWP_NOZORDER | SWP_NOSIZE | SWP_NOMOVE | SWP_FRAMECHANGED.

```
/*
   HHOOK.C
   By Pete Davis & Jim Mischel
   PC Magazine Vol. 14, No. 15
*/

#include <windows.h>
#include <toolhelp.h>
#include "hhook.h"

int PASCAL WinMain (HANDLE hInstance, HANDLE
  hPrevInstance, LPSTR lpszCmdLine, int nCmdShow) {
    static char szAppName [] = "HelpHook" ;
    MSG msg;
    HWND hwnd ;
    WNDCLASS wndclass ;

    if (!hPrevInstance) {
        wndclass.style = CS_HREDRAW | CS_VREDRAW ;
        wndclass.lpfnWndProc = MainWndProc ;
        wndclass.cbClsExtra = 0 ;
        wndclass.cbWndExtra = 0 ;
        wndclass.hInstance = hInstance ;
        wndclass.hIcon = LoadIcon (hInstance, szAppName) ;
        wndclass.hCursor = LoadCursor
        (NULL, IDC_ARROW) ;
        wndclass.hbrBackground = GetStockObject
        (WHITE_BRUSH) ;
        wndclass.lpszMenuName = NULL ;
        wndclass.lpszClassName = szAppName ;

        RegisterClass (&wndclass) ;
    }

    hwnd = CreateWindow (szAppName, "HelpHooker",
    WS_OVERLAPPEDWINDOW,
    CW_USEDEFAULT, CW_USEDEFAULT,
    CW_USEDEFAULT, CW_USEDEFAULT,
    NULL, NULL, hInstance, NULL) ;

    ShowWindow (hwnd, SW_HIDE) ;
    UpdateWindow (hwnd);

    while (GetMessage (&msg, NULL, 0, 0)) {
        TranslateMessage (&msg) ;
        DispatchMessage (&msg) ;
    }
    return msg.wParam ;
}


void HookDLL(HMODULE hModule, HINSTANCE hInst) {

LPBYTE      lpModule;
long        (FAR PASCAL *lpfn_FAPI) (LPSTR, WORD, DWORD);
char        Command[256];

        /* Convert WinHelp to a DLL */
        lpModule = GlobalLock(hModule);
        lpModule += 0x0D;
        *lpModule = *lpModule | 0x80;


        /* Get Address of exported FApi() function */
        (FARPROC) lpfn_FAPI = GetProcAddress(hInst,
         "EXPFAPI");

        /* Convert WinHelp back to an EXE */
        *lpModule = *lpModule & 0x7F;
        GlobalUnlock(hModule);

        lstrcpy(Command, "RR('helphook.dll',
```

FIGURE 1: *This program finds all instances of WinHelp and attaches each one to HELPHOOK.DLL.*

These are just a few of the things you can do with the Windows API from WinHelp. One of the major limitations is that you can't use any sort of variables to store values returned from functions. One possible extension would be to create a DLL that actually handled variables. This would allow storing values from API calls and using them in other calls.

Here's what such functionality could look like. Assume you have the following two functions:

```
void SaveIntVar(LPSTR VarName,
 int VarValue);
int GetIntVar(LPSTR VarName);
```

You could then implement things such as the following:

```
SaveIntVar("hWnd",
 GetDesktopWindow());
MessageBox(GetTopWindow(GetIntVar
 ("hWnd")), "Message", "Notice", 0);
```

This could also be done with embedded calls, but the idea is to show you how such a set of routines could work. Implementing it would be fairly simple for the average programmer. Of course, you'd need a separate set of routines for different variable types, but each routine would be fairly similar.

CALLING WINHELP'S EXPORTED ROUTINES

One thing that's always been a problem with WinHelp is that to attach a DLL, you need to be the author of the help file. You can't add functionality to just any instance of WinHelp. But with the help of the book *Undocumented Windows,* by Andrew Schulman, Dave Maxey, and Matt Pietrek (published by Addison-Wesley), there is a way around this.

In our example, we want WinHelp to load our DLL and start communicating with our LDLLHandler(). To do this, you need some way to get WinHelp to call a function in that DLL. You could call the WinHelp()API with a macro that calls a function in your DLL. For example, our DLL contains the function LoadHELPHOOK (). The following calls to the WinHelp()API would load the DLL:

```
  WinHelp(hWnd, "helpfile.hlp",
   HELP_COMMAND, (DWORD)
   (LPSTR) "RR('HELPHOOK',
'LoadHELPHOOK', ");
  WinHelp(hWnd, "helpfile.hlp",
   HELP_COMMAND,(DWORD) (LPSTR)
   "LoadHELPHOOK()");
```

This works fine unless the instance of WinHelp was started with WinExec() instead of the WinHelp()API. In that case, you'd have to start up a second instance of WinHelp with the WinHelp()API. This is sloppy at best. The other option is to use the FApi() function which is exported by WinHelp. FApi() has the same functionality as the WinHelp()API, except that it works regardless of how WinHelp was started. The only problem is that to get the address of FApi(), you need an LDLLHandler() function to receive the callback addresses from WinHelp. This is sort of a catch-22 situation. Or is it?

Why not use GetProcAddress() to get the address of the FApi() function from WinHelp? The immediate problem is that you can

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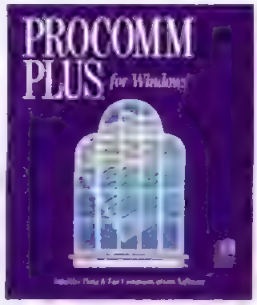

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CIRCLE 935 ON READER SERVICE CARD

```
        'LOADHOOKDLL', 'S')");
        lstrcat(Command, ";LoadHookDLL(qchPath)");
        /* Call FApi() */
        _asm {
           mov   ax, 0
           push  ax
           push  ax
           mov   ax, 102h
           push  ax
           lea   ax, Command
           push  ds
           push  ax
           mov   ax, hInst
           call  lpfn_FAPI
        }
}


void HookAll() {

TASKENTRY  TE;

        TE.dwSize = sizeof(TASKENTRY);
        TaskFirst(&TE);

        if (!TE.hModule) {
           MessageBox(NULL, "TaskFirst function call
                     failed",
                   "Error", MB_OK);
           return;
        }

        while (TE.hNext) {
           if (!lstrcmp(TE.szModule, "WINHELP"))
              HookDLL(TE.hModule, TE.hInst);
           TaskNext(&TE);
        }
}


long _far _pascal _export MainWndProc (    HWND hwnd,
                     UINT message,
                     UINT wParam,
                     LONG lParam) {

HINSTANCE  hInstDLL;
int           i;

    switch (message) {

            case WM_CREATE:

              hInstDLL = LoadLibrary("HELPHOOK.DLL");
              HookAll();
              for (i=1; i<=20; i++)
                 Yield();
              FreeLibrary(hInstDLL);
              PostMessage(hwnd, WM_DESTROY, 0, 0L);
              Yield();
              break;

            case WM_DESTROY :
            PostQuitMessage (0) ;
        return 0 ;
    }

    return DefWindowProc (hwnd, message, wParam,
                          lParam) ;
}
```

use GetProcAddress() only to get the address of functions in a DLL, not in an .EXE. (Remember that USER.EXE, GDI.EXE, and so on are all really DLLs.) No problem: We'll just turn WinHelp() into a DLL for a second, do the GetProcAddress(), and turn it back into a task. This is where *Undocumented Windows* comes in handy. Looking at page 321, we see that the word at offset 0x000C of the module table entry has a bit that's set or cleared to reflect whether the module is a DLL or a task. This happens to be exactly what GetProcAddress() checks.

Now all we need is the module handle. Unfortunately this isn't as simple as doing a GetModuleHandle() with WINHELP.EXE. The problem is that there could be multiple instances of WinHelp. How you go about this really depends on what you want to accomplish. We do it by attaching our DLL to every instance of WinHelp currently running.

HHOOK.C

By calling TOOLHELP.DLL's TaskFirst() and TaskNext(), we traverse the Task List and search for module handles and instance handles belonging to WinHelp. This takes place in the HookAll() function in Figure 1.

Armed with the module handle and instance handle, we can now turn WinHelp into a DLL, call GetProcAddress(), turn WinHelp back into an .EXE, and then tell WinHelp to hook our DLL. This all takes place in the HookDLL () function in Figure 1.

The only unusual aspect of this is that we need to handle the call in assembly language. The reason for this is that the AX register must contain the selector for the data segment when you call FApi(). This has to do with the fact that FApi() is a callback function. More of an explanation would be beyond the scope of this article, so I'll just provide a description of the parameters.

First, we load AX with 0 and push that twice. That passes a NULL for the help file name: Since we don't want WinHelp to change files, we don't need to pass a filename. Next, we pass 0x102 . This is the wCommand parameter HELP_COMMAND. In other words, we're telling WinHelp that the last parameter is a string containing a macro we want it to execute. The final parameter is the address of the variable Command, which is a string containing our macro. The final two steps are to load AX with the instance handle (which is the same as WinHelp's data segment selector) and finally call FApi().

```
/* Call FApi() */
_asm {
 mov   ax, 0
 push  ax
 push  ax
 mov   ax, 102h
 push  ax
 lea   ax, Command
 push  ds
 push  ax
 mov   ax, hInst
 call  lpfn_FAPI
}
```

That's all that's required to hook a DLL into WinHelp. All you need at this point is the DLL.

What's New in WinHelp 4.0

By Pete Davis

Microsoft Windows 95 will introduce a new help engine, WinHelp 4.0. Although the new help engine is based on the code of the old engine, it has undergone a complete overhaul. The look and feel of WinHelp itself has changed considerably.

The most noticeable new feature will probably be the Contents Tab (Figure A). The Contents Tab is essentially a table of contents for your help file that provides an expandable/collapsible tree of topics. This much-needed new feature will aid users in navigation of large help files.

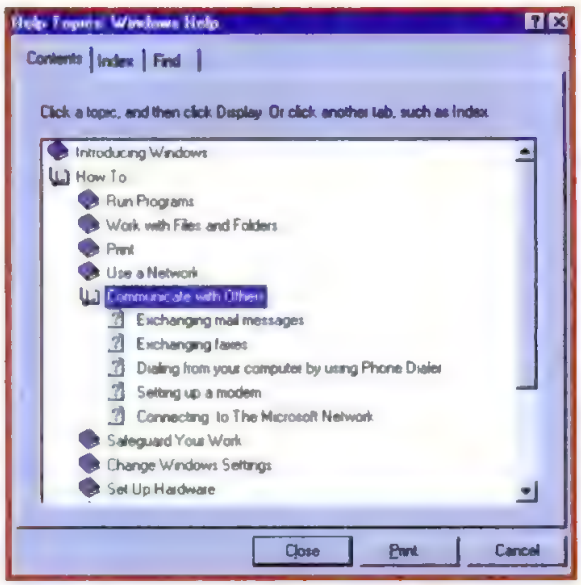
With the Contents Tab, users can now print a range of pages instead of printing one page at a time. By selecting a "book" from the Contents Tab, users can print all the topics contained within the tab.

A related feature is a new set of printing macros that let the author give users a choice of multiple topics to print. The range of topics to be printed must be defined by the help author; there is still no facility that lets users define any arbitrary range or group of topics to print.

One of the more useful new features is the Find Tab. The Find Tab is much the same as the keyword search list from WinHelp 3.x. The biggest difference is the ability of the user (not the help author) to combine keyword lists from various help files into a single list, allowing keyword searches across multiple help files.

Another feature that WinHelp developers have been demanding for years is support for 256-color bitmaps. Until now, the only way to get that support was either to write a WinHelp DLL or to buy one. WinHelp 4.0 will support not only 256-color bitmaps, but 24-bit bitmaps as well. This will allow WinHelp developers to include bitmaps of much higher quality with their help files.

In addition to this, WinHelp now supports "transparent" bitmaps. With previous versions of WinHelp, when you placed a bitmap in a topic, the background of the bitmap would overwrite the topic's background. So if your topic window had a blue background and your bitmap had a white background, there would be a white square with your bitmap inside of it and a blue background. This isn't always a desirable effect. WinHelp 4.0 allows you to make a bitmap "transparent," so that a white background in the bitmap is automatically excluded from the drawing. Instead of having a white square, you'd simply see your bitmap over the background of the topic.



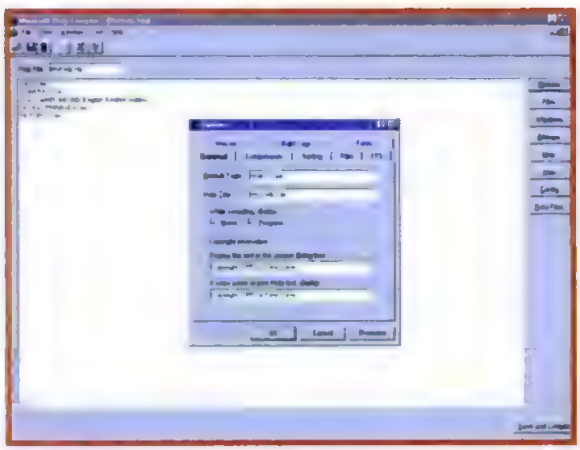


FIGURE A: *The Windows 95 help system now presents a Contents Tab, with a collapsible outline of "books" containing topics.*

FIGURE B: *The new Help Project Editor provides a superior way to build .HPJ files.*

Authorable buttons are also a new addition. An authorable button is simply a standard Windows button that you can include anywhere in your help-file text. The help author can supply the text for the button and assign a macro to it. In the past, the only easy way to do this was to create a bitmap that looked like a button, bring it into SHED (Segmented Hypergraphic EDitor), and create a hot spot for the entire bitmap. Authorable buttons will be coded in your RTF file, much the way that bitmaps are coded.

Secondary windows have been improved tremendously in WinHelp 4.0. In previous versions, secondary windows were very limited in what they could do. For example, there was no menu or button bar for secondary windows. You were also limited to one secondary window open at a given time. WinHelp 4.0 eliminates these restrictions.

According to sources at Microsoft, WinHelp developers can now be assured that they will be receiving complete documentation of all WinHelp macros. WinHelp 3.1 had quite a few undocumented macros. All of those macros will supposedly be documented, as will all the new macros. Additionally, all macros from WinHelp 3.1—even the undocumented ones—will be carried over to WinHelp 4.0. That means that your Windows 3.1 help files should be completely compatible with WinHelp 4.0.

Speaking of compatibility, here is another issue: In an effort to be as compatible as possible, WinHelp 4.0 will link to 16-bit DLLs. So if you have an old 16-bit DLL that allows you, for example, to play .AVI files in WinHelp, that DLL should work fine with WinHelp 4.0. How seamlessly, I can't say for sure. I have seen quite a few DLLs work properly, and I have seen only one fail.

WinHelp 4.0 also includes a new Project Editor (Figure B). Though it's not in the same league as the commercial help-authoring packages, it's a far cry better than the old days of manually typing in your help-project files. The Help Project Editor doesn't handle any of the work in building RTF files, but it does handle any work in the .HPJ file that you might need.

Many of WinHelp 4.0's new features are exactly what users have been seeking. All of them mean more power and flexibility for help authors and users alike.

HELPHOOK.DLL

By registering the routine LoadHookDLL() from HELPHOOK.DLL (see Figure 2) and calling LoadHookDLL(), we've now forced WinHelp to search for the LDLLHandler() in HELPHOOK.DLL. The LoadHookDLL() function itself doesn't do anything. This is a common method for getting WinHelp to check for an LDLLHandler() in a DLL.

HELPHOOK doesn't do a whole lot. It's a contrived example but one that shows how this method works. HELPHOOK simply installs the LDLLHandler() and gets the callbacks using GetWinHelpCallbacks(). (For more details, refer to the Power Programming column "Undocumented WinHelp, Part 1" in our issue of July 1995.) HELPHOOK then calls the LGetHPath() macro from HELPDLL.C to get the path for the current help file. Then a message box is popped up saying, "Hooked into: d:\path\helpfile.hlp," where "d:\path\helpfile.hlp" is the path and filename of the help file that HELPHOOK has been hooked into.

PUTTING IT ALL TOGETHER

At this point, we now have an application and a DLL. Copy the DLL into the \WINDOWS\SYSTEM directory. This way any help file can be sure to find it. (Make sure you don't already have a HELPHOOK.DLL in your \WINDOWS\SYSTEM directory.) Now run one or more instances of WinHelp with whatever help files you want. After you have them open, run HHOOK.EXE. This will attach the DLL to all instances of WinHelp. For each WinHelp instance, a message box will appear telling you that the DLL has attached to that instance.

Obviously, this kind of work lends itself to an incredible number of applications. Only in the past year or so has information on WinHelp programming become available to the public. Because it is such a closed system, WinHelp sometimes requires creative methods to keep it under control. We hope you'll find these techniques useful, and maybe they'll give you ideas for even more creative WinHelp projects. We're always interested in what people are doing with WinHelp, so if you're developing something really cool, drop us a line and let us know about it. □

Jim Mischel is a programmer for Cinematronics, a game developer based in Austin, Texas. He is the author of The Developer's Guide to WINHELP.EXE, *published by John Wiley & Sons. He can be reached on CompuServe at 75300,2525.*

Pete Davis is an independent contractor working primarily for Wextech Systems. He is currently writing a book tentatively titled Undocumented Windows File Formats, *which should be available this summer from R&D Publications. He can be reached on CompuServe at 71644,3570.*

```
/*
      HELPHOOK.C
      by Pete Davis & Jim Mischel
      PC Magazine Vol. 14 No.15
*/

#include <windows.h>
#include "helpdll.h"
#include "helphook.h"

int FAR PASCAL LibMain (HINSTANCE hInst, WORD wDataSeg,
      WORD cbHeap, LPSTR lpchCmdLine) {

      return 1;
}

int FAR PASCAL _export WEP(int nParam) {
      return 1;
}

/* Do nothing function. Just insures that LDLLHandler gets loaded */
void FAR PASCAL _export LoadHookDLL(LPSTR lpPath) {
      return;
}

/* LDLLHandler - Respond to WinHelp messages */
long FAR PASCAL _export LDLLHandler(WORD wMsg, LONG lParam1, LONG
                                    lParam2) {


static charMessage[256];
LPSTR    lpPath;

      switch (wMsg) {
         case DW_WHATMSG :
            return (DC_CALLBACKS | DC_INITTERM);

         /* Get callback addresses */
         case DW_CALLBACKS :
            GetWinHelpCallbacks ((VPTR)lParam1, lParam2);
            lpPath = LGetHPath(NULL);
            lstrcpy(Message, "Hooked into: ");
            lstrcat(Message, lpPath);
            MessageBox(NULL, Message, "Notice", MB_OK);

            return TRUE;

         case DW_INIT :
            return TRUE;

         case DW_TERM :
            EndWinHelpDLL (NULL);
            return TRUE;

         /* Ignore any other messages */
         default :
            return FALSE;
      }
}
```

FIGURE 2: *This routine has a simple LDLLHandler() function that lets you know when it is attached to a help file and what that help file is.*

By Bill Schindler and Esther Schindler

Making the Most of the Workplace Shell

Navigating your way through OS/2's object-oriented interface.

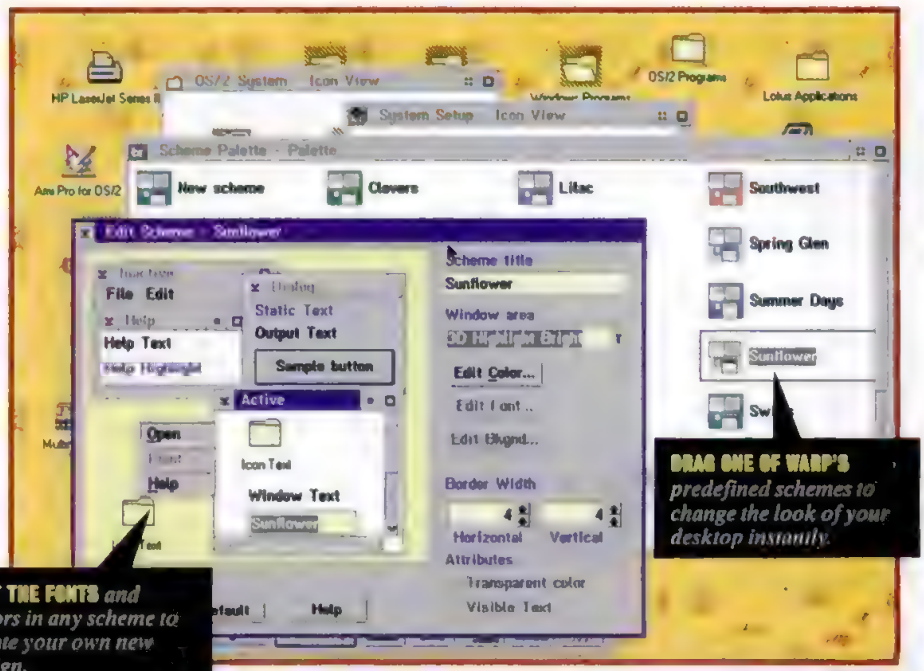
OS/2 enthusiasts often point to the Workplace Shell (WPS) as a prime illustration of the operating system's elegant balance between consistency and flexibility. All too often, though, you're left to discover the advantages of the Workplace Shell on your own. Let's take a look at some of the underlying concepts and capabilities of the WPS and explore some of the ways you can take advantage of its power.

The Workplace Shell is an object-oriented user interface. Everything on the OS/2 desktop is an object, including the desktop itself. You've probably heard the term object-oriented used most often in relation to programming topics, but Warp uses this technology to hide the intricacies of the operating system, easing the way you interact with your computer. Users work with folders and documents rather than programs. Thus, for example, printing is a simple matter of dragging your document object to the printer icon.

The WPS is based on IBM's System Object Model (SOM), a language-neutral standard for developing objects that can interact with each other. With SOM, objects can be created using different programming languages, including traditional non-object-oriented languages. SOM objects can be dynamically linked, so you can create and add new Workplace Shell object types at any time.

Basic to the definition of object-oriented technology is that each object can inherit behaviors from common predefined objects. Thus, every object has an object menu that is activated, always, by single-clicking the right mouse button when the mouse pointer is positioned on top of an object. And most object menus share a standard set of inherited items, such as open, settings, help, and move. (Other menu items may vary, though, depending on the type of object. Some may in fact be turned off; for example, you cannot delete the Shredder—the Delete option doesn't even appear.)

What this means for the user is consistency: You can expect certain actions to produce certain results. But this consistency doesn't constrain you—you aren't forced to work in any particular manner. The WPS lets you change dozens of options, from the way objects are displayed to how you organize the objects and data with which you work. In fact, the WPS allows so much flexibility that it's rare to see two OS/2 systems with similar-looking desktops. And OS/2 takes care of a lot of the housekeeping for you. For example, if you move a file referenced by a WPS object, the links in the object are automatically updated.



EDIT THE FONTS *and colors in any scheme to create your own new design.*

DRAG ONE OF WARP'S *predefined schemes to change the look of your desktop instantly.*

FIGURE 1

Associated with every WPS object is a collection of tabbed dialog boxes called a settings notebook. To modify the way an object behaves, you choose options on tabbed pages. As with object menus, what you find in a settings notebook varies by the type of object it controls, but quite a few options (such as name and icon) are standard across the board.

The Workplace Shell permits many types of objects. The four primary ones are folder objects, program objects, data objects, and device objects.

FOLDER OBJECTS

Folders are containers that can hold other objects. They are similar to Windows 3.1 groups, except they may also contain other folders or devices, and they can be freely placed on the WPS desktop. Folders are visual representations of directories in the file system. The WPS desktop itself is defined as a folder, and it behaves just like any other folder. If you examine the structure of the \Desktop directory and its subdirectories on your boot drive, you'll see a map of your WPS desktop. Note that if you use the FAT file system instead of OS/2's High Performance File System, you'll see only the short version of the names here. Most of the desktop information is stored in extended attributes associated with the \Desktop subdirectories or in OS/2's binary OS2.INI and OS2SYS.INI files. (Extended attributes consist of extra information associated with a file, such as a file type, an icon, or a comment; each can be up to 64K in size.)

The same WPS folder can display its contents using any or all of the different views: Icon, Details, Tree, and Settings. To open a folder in a view other than the default view, click the right mouse button on the folder to bring up the object menu, select Open, and then select the desired view. Select the settings view by clicking on Settings, just below the Open option.

If you're used to the Windows 3.1 Program Manager, you'll find the default icon view most familiar. You may prefer the details view,

though, if you're more comfortable with the Windows 3.1 File Manager. This view shows object and file information including the creation date, when the file was last accessed and modified, and so forth. The tree view shows the hierarchical relationships among folders, much like directories and subdirectories. Several options exist within each view to control the display of objects; for instance, to sort icons automatically, select Non-grid on the folder's settings notebook and "Always maintain sort order" on the Sort page. The Background page in a folder's settings notebook controls the color or bitmap displayed in that folder. Users often enjoy changing the backgrounds of many different folders, including the WPS desktop.

FIGURE 2: *Drag any object to the Launchpad for easy access. For greater convenience, you can create multiple custom Launchpads.*

The Workplace Shell supports a special kind of folder called a work folder, which is especially useful if you often need to move from one project to another. The WPS "remembers" the state of a work folder's objects when you open, close, or minimize the folder. For example, suppose your work folder contains a word processor document, a (regular) subfolder, and an accounting application—all of which are running or open. When you close the work folder, OS/2 closes the word processor, the accounting program, and the subfolder. The next time you open the work folder, the applications will start and load the correct word processing document, and the subfolder will open. Minimizing a work folder minimizes all of the objects inside it, open or not. To turn a folder into a work folder, click on "Work folder" on the File page in a folder's settings notebook; notice that the WPS desktop is marked as a work folder.

The Drives folder is another special kind of folder that lets you view all of the drive objects in your system—hard or floppy disks, logical drives, CD-ROMs, and so forth. Unlike other folders, you can't delete the Drives folder, and you can't create, delete, move, or copy objects within it. Use the drives object to work directly with disk contents; you can display file and disk information and move or copy files. If you're used to the Windows 3.1 File Manager, the Drives folder may at first seem less fully featured. But if you experiment and customize by bringing up object menus on the drives and their folders, you'll find it a useful tool.

PROGRAM OBJECTS

Program objects look like icons, but they are actually much more. A program object is a reference to any file that starts a program, including DLLs, executables, and batch files. Since a program object is not the program itself, you can create several program objects that point to the same executable. For instance, you can create two program objects that start Paradox for Windows (or DBExpert for OS/2, or Q+A for DOS—the rules apply equally); the first might use one DOS memory management setup, while the second might load a specific database using command line parameters and perhaps a different set of memory options.

To customize a program object, you modify options in its settings notebook. You can change an application's paths and parameters (much like Windows' Properties), and you can also define whether a Windows application is to run seamlessly (that is, in a window) on the WPS desktop, in a full-screen session, in a separate DOS session, and so on. You'll also find the DOS and Windows settings here; these settings include dozens of attributes that control how OS/2 manages memory, device drivers, and interaction with the operating system when the application is run. The ability to create separate program objects, each of which points to the same program, provides a lot of flexibility in the way you run applications.

DATA OBJECTS

New OS/2 users are often confused by the difference between a program object and a data object. Unlike a program object, a data object is not a reference to a file but the actual file itself, usually a data file. Deleting a program object does not delete the executable, but if you delete a data object, it's gone. You can associate

A Sampling of WPS Add-Ons

As with other user interfaces, third-party products are available to enhance, maintain, and otherwise improve the Workplace Shell. Here's a sampling of the dozens you can acquire.

▶ For serious OS/2 users, any one of DeskMan/2's many features makes this product indispensable. DeskMan/2, from Development Technologies (803-790-9230), backs up your desktop or parts thereof, optionally saving restoration information as a reusable REXX program. DeskMan/2 makes modifying desktop objects easy while preventing users from, say, deleting or moving anything in the OS/2 System folder. If you use a network, DeskMan/2 can automatically download a specific desktop at log-on time, so that Jane gets her predefined desktop no matter which computer station she uses today.

▶ If you don't like the OS/2 Warp Launchpad, check out SkyScraper, from Binar Graphics (415-491-4182). SkyScraper splits your desktop into several floors and desks. It lets you keep different folders and applications open, yet out of each others' way. For instance, you can use the Internet Access Kit on one SkyScraper desk, a word processor in another, and a full-screen Windows application in yet another. SkyScraper is a great tool if you run several applications concurrently and are always short on virtual desktop space.

▶ Among the hundreds of free OS/2 applications available, the IBM employee-written Extended Desktop is worth noting. Extended Desktop can optionally remove Arrange and Sort from the Desktop context menu. You can align groups of icons and use snap-to-grid to position objects precisely. You'll find it as EXDESK.ZIP in the OS2USER forum on CompuServe.

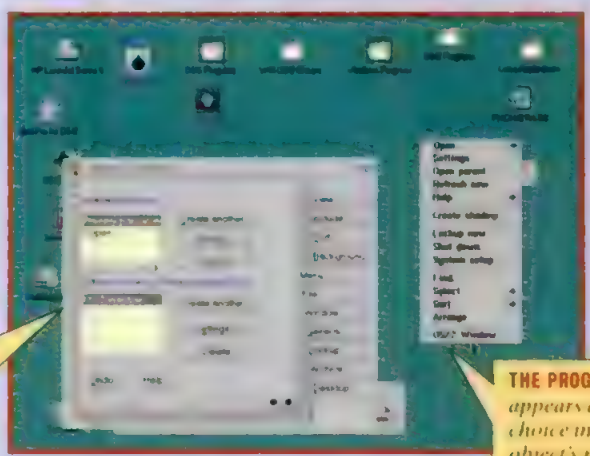
▶ Multimedia support is built into the Workplace Shell, and BocaSoft's System Sounds takes advantage of this, attaching audio .WAV files to system events and keystrokes. It includes far more than the two or three dozen .WAV files that come with OS/2's native multimedia. And a developer's kit is included too, so you can easily enable your own OS/2 programs. Contact BocaSoft at 407-241-1812.

▶ If you really miss the Windows File Manager, you'll find a host of OS/2 replacements, from FM/2 by shareware author Mark Kimes (at CompuServe ID 74601,1327) to FileStar from SofTouch (405-947-8080) to DirMaster, which is included with OS/2 Essentials from Stardock Systems (313-207-1779).

Adding Items to Object Menus

As one illustration of the WPS's extensibility, you can customize any folder's object menu, including adding program objects to the list of menu choices. For example, this is how you would add a menu item to the Desktop's object menu to start an OS/2 command window:

- Click the right mouse button on an empty area of the Desktop to display the Desktop's object menu.
- Select Settings to display the Desktop's settings notebook.
- Select the Menu tab.
- Open the OS/2 System folder by double-clicking the left mouse button on the folder.
- Open the Command Prompts folder by double-clicking on it.
- Place the mouse pointer over the OS/2 Window icon and press and hold the right mouse button.
- While holding the right mouse button, drag the program object to the Actions on Menu list box.
- Release the right mouse button to drop the program object.
- Close the Settings notebook.



DROP A PROGRAM *object into the Actions on Menu list box in another object's settings notebook.*

THE PROGRAM ITEM *appears as a new choice in the other object's menu.*

Now right-click on an empty area of the Desktop and the Desktop's object menu will display an additional menu item: OS/2 Window. When you select this menu item, an OS/2 command prompt window will start, just as if you had double-clicked on the OS/2 Window object.

You'll notice, though, that starting an OS/2 Window from the object menu gives you an error message. When you use pop-up menus, the desktop sends the name of the object as a parameter. This confuses some programs, including CMD.EXE. The error message displayed when you start a command session this way doesn't actually hurt anything, but, needless to say, it is annoying. Here's how to eliminate it:

- Open the settings folder for the program object—in this case, the OS/2 Command Prompt.
- Select the Program tab (if that's not the one already displayed).
- In the Parameters field, type in a percent sign (%).
- Close the settings notebook.

data objects with applications and instruct the program objects to recognize certain extensions. Then, when you double-click on a data object, the application will start, loading the data object.

DEVICE OBJECTS

Device objects provide a means of communication between the computer and attached equipment, such as a printer. To a large extent, device objects are extended attributes connected to related driver files, and they have settings notebooks to control how the device is used—whether a printer, for example, will be in portrait or landscape mode. You can make copies of device objects and customize them. You can create one printer object for ordinary portrait printing and a second that uses the envelope feeder settings. Then you need only drag a data object to the correct printer object in order to print with a specified layout.

WORKING WITH OBJECTS

The easiest way to create new objects is to use the Templates folder. Templates are like cookie cutters for new objects: They let you create a new item of the template's type. OS/2 supplies many predefined templates, such as Data File, Folder, Printer, and Program. To create a new program object, for example, you drag a Program template out of the Template folder and drop it on the desktop or another folder. OS/2 will prompt you for any missing information, such as the program's path and default directory. If it's a DOS or Windows application, OS/2 will look up the program in its database and change the DOS/Windows settings to reflect recommended values.

You can also create your own template for any existing object. Suppose you have a word processing document with your company letterhead. You can make it into a template by opening the settings notebook and selecting the Template check box from the General settings page. When you create new objects from the template, they will have the same contents and settings as the original, including associations. This feature makes it quick and easy to create, say, a new Internet mail message, a spreadsheet, or a predesigned envelope document.

Drag-and-drop is used more extensively and consistently in OS/2 than it is in Windows. You can use it almost anywhere. Drag a data object to the printer to print it or to a program object to launch the application. Drag a phone book entry from the IBM Works PIM to a data object to associate the phone number with the object; then drop the object on the fax printer icon. Faxworks will send the file to the associated fax number, automatically.

To drag an object, put the mouse pointer over the object, press and hold the right mouse button, and drag. The default drag operation is a move for all objects except templates, although in certain cases—dragging a file from one drive to another, for example—OS/2 assumes that you want to copy a file rather than move it. You can force particular actions using the augmentation keys: Pressing Ctrl while dragging creates a copy of the object; pressing Shift forces a move; and pressing Ctrl-Shift creates a shadow (shadows are discussed below). Use these keys if you actually want to copy, move, or create a shadow of a template (since dragging a template simply produces a new copy of the object type).

You can also drag-and-drop by selecting the Pickup option on the object menus. Use this option if you want to drag multiple objects, perhaps from different folders. Just choose Pickup from the object menu of each object you want to include, then select Drop from the target object's pop-up menu. The Drop option's submenu lets you choose whether the accumulated objects should be copied, moved, or shadowed.

SHADOWS

The WPS incorporates a powerful feature called shadowing. A shadow is a special type of object that holds no information itself but instead points to another object, thus using few resources of its own. Modifications made either to the original object or to the shadow are reciprocal—changing one immediately changes the other. But, while you can delete a shadow with-

out affecting the original object, deleting the original makes the shadow disappear as well.

Shadows are a potent tool for customizing your Warp desktop. Because a shadow allows an object to appear to exist in more than one place at the same time, you can have a program, data file, or folder accessible from several locations without using many resources. While you always have the option to make copies of an object, shadows make it easier to maintain, since you have to make only one change when you do have to change something. Use shadows to make a frequently used object more accessible; for instance you can shadow a hard disk directory or an application to the desktop. Or use them to arrange your desktop so you can work from various perspectives; for instance, you could run your word processor from a "word processors" folder but also shadow the program object to a "projects" folder.

THE LAUNCHPAD

Much has been made of OS/2 Warp's Launchpad, but it's just another class of object (a kind of palette, to be exact, using shadows). You can drag any object to the Launchpad, and thereafter when you click once on its Launchpad icon, the object will be opened. Using the Launchpad makes it easy to get started with Warp and simple to get to your frequently used applications and folders. If you like the Launchpad, note that you can create and customize secondary Launchpads.

Another way to handle frequently used applications is to add them to your desktop (or another folder's) object menu. See the sidebar "Adding Items to Object Menus" for detailed instructions.

PALETTES

Everyone likes to change the appearance of the desktop. You use another special type of WPS object—a palette—to modify the fonts, colors, or entire visual scheme of other objects:

- The Font Palette lets you change the typeface of any text in the WPS interface as well as add new fonts to your system and delete existing fonts.
- Two color palettes let you customize colors. The Solid Color Palette contains the 16 colors usually available on all video adapters; the Mixed Color Palette is for high-resolution displays and contains 256 colors. You can maintain multiple copies of each palette and edit the colors in each.
- The Scheme Palette contains several predefined color and font combinations that you can apply to a window or your desktop. You can edit the fonts and colors in any of the schemes to create new schemes.

Open any of the palettes and drag and drop colors, fonts, or a whole new scheme on WPS objects and WPS-enabled OS/2 applications to change the appearance of your system.

Despite the visual nature of the WPS, many people remain most comfortable with a command line interface. OS/2's command line interface looks and feels like the standard DOS interface, and its commands are extensions of the familiar DOS commands. The default command processor is CMD.EXE, located in the OS/2 directory. It provides several common internal commands such as DIR and DEL, and it also executes files with .COM, .EXE, .CMD, or .BAT extensions. OS/2 commands can be run from either a full-screen OS/2 session or an OS/2 window. For a description of the commands, see the OS/2 Command Reference in the Information folder.

All this power is refreshing, but it would be tedious to customize everything on the desktop by hand. Luckily, OS/2 supplies a tool to ease the task, an interpreted language called REXX that we'll cover in depth in a future issue.

Because of its consistency, becoming comfortable with the WPS is easy. Because of its flexibility, making it your own is even easier. □

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by Douglas Boling

A New Look for an Old Friend

Make your Windows 3.1 system look like Windows 95.

The times they are a-changin'. Change is the norm in the personal computer industry, but with the release of Microsoft Windows 95, events are moving at light speed. Windows 95 brings a new look, a new programming interface, and new opportunities to the PC. But what about all of us still stuck with Windows 3.1? Are we to be left without that cool new look? Take heart, Windows 3.1 users, this issue's utility will give you that Windows 95 look.

WinBar is a Windows 3.1 version of the Windows 95 Taskbar. Like the Taskbar, WinBar is very configurable. In fact, WinBar has more flexibility than the Taskbar. And like the Taskbar, WinBar lets you configure its Start menu to contain programs, Control Panel applets, and nested submenus. The difference is that WinBar lets you configure the bar itself. You can add fields in WinBar's window to perform any function that can be added to a menu. So with a few quick moves, you can add buttons to launch your favorite programs right on the bar!

If you want to go whole hog, you'll use WinBar as your Windows shell. WinBar implements the necessary interfaces to take the place of the Windows 3.1 Program Manager. When configured as your Windows shell, WinBar will launch the programs in your Startup group as well as those listed on the LOAD and RUN lines in WIN.INI. As with Program Manager, holding down the Shift key when WinBar is started will prevent the programs in the Startup group from being launched.

If you like the look of Windows 95 but you are stuck with Windows 3.1, you can have that new look by downloading WinBar from Ziff-Net on CompuServe or from the Internet. (See the sidebar "Guide to Our Utilities" for details.) WinBar is written in standard C. You can also download the C source code and all necessary files to compile WinBar with any compiler compatible with Microsoft C 6.0.

USING WINBAR

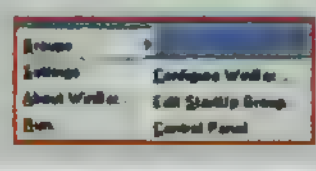
To install WinBar, copy the two files WINBAR.EXE and WBDLL.DLL to a directory listed in your PATH statement. If you wish to make WinBar your Windows shell, you will need to copy WBDLL.DLL to your Windows system directory. You will also need to change the SHELL statement in SYSTEM.INI to list the completely specified WinBar filename.

You start WinBar as you would any Windows program, either from the File | Run menu item in Program Manager or by creating an icon in Program Manager and double-clicking on it. When used as the Windows shell, WinBar is launched instead of Program Manager. You can still run Program Manager, but you must close WinBar rather than Program Manager to end your Windows session when WinBar is the shell. Figure 1 shows a Windows session with WinBar used as the shell.

IN THIS ISSUE

WinBar

WinBar is a highly configurable rendition of the Windows 95 Taskbar that runs under Windows 3.1. It can launch programs either from its menu structure or from an icon. WinBar can replace Program Manager as your Windows shell.



One feature that WinBar does not implement is the Program Manager DDE interface that lets other programs create new groups and program icons. If you install a program and you are using WinBar as your shell, you should start Program Manager before you install the new software. Once the installation is complete and any new groups are created in Program Manager, you can close Program Manager. WinBar provides a way—to be discussed shortly—to copy that new group information to a WinBar menu.

The first time you start WinBar, it creates its menu structure with information gleaned from the Group files used by Program Manager. WinBar then creates its bar across the bottom of your screen. The icons at the bottom of the screen are moved up so the bar does not hide them.

Once WinBar completes its initialization process, you will see a bar across the bottom of your screen with two buttons on the left side and two fields, one for the date and the other for the time, on the right. Clicking on the leftmost button, labeled Programs, will display the main WinBar menu. Notice that the menu has a three-dimensional look to it, similar to the menus in Windows 95. The menu has five items: Groups, Settings, About, Run, and Exit.

The Groups item is a submenu containing nested menus for each group in Program Manager. Clicking on any of the group menus will display the list of programs contained in that group. Clicking on a program name will launch that program.

Just below the Groups submenu is the Settings submenu. The Settings submenu contains three items: Configure WinBar, Set Startup, and Control Panel. Selecting the Configure WinBar item displays the Configuration dialog box, which is the key to configuring WinBar. The dominant control in the Configure dialog box is a list box detailing the fields on the bar. In the list box, the Programs and Windows fields are followed by a Separator item and the Date and Time fields.

Along the right side of the dialog box is a column of buttons. I'll talk about the Add and Edit buttons in a moment. First, however, select the current date field in the list box and click the Cut button. The date field will disappear in the list box and on the bar. Clicking on the Paste button restores the field. Clicking again adds a second date field to the bar. This clipboard is quite handy for configuring fields on the bar and in the menus. As you'd expect, the Copy button copies a field's contents into the clipboard without deleting the field itself.

The Set Font button lets you set the font used by WinBar. The dialog box used to select the font is the common Font Selection dialog used by most Windows programs. You can specify any font loaded on your system and you can set the font to almost any size, though selecting a huge font makes the bar pretty unusable. Instead of limiting the choices for safety's sake, I chose flexibility and left the responsibility for good choices to the user.

The Load Groups button provides a method for migrating Program Manager

groups over to WinBar when this is necessary. Typically, installation routines for new programs will add a new group to Program Manager. Instead of manually copying the data to WinBar, you can click on the Load Groups button. A list of all Program Manager's groups will be displayed. Selecting a group name and clicking on the OK button will copy the contents of that group to the clipboard. From there you can paste into a WinBar menu or directly on the bar itself!

You can also set a hotkey for bringing WinBar quickly to the foreground. Be careful when selecting a hotkey to avoid key combinations that are commonly used by Windows applications, such as Alt-F or Alt-E. Note, too, that Windows has a systemwide limit of eight window hotkeys. If you have eight other windows on the desktop with hotkeys defined, the WinBar hotkey will not work.

The Configure box dialog also contains three check boxes. The first one tells WinBar to save any changes to its configuration automatically when the program terminates. The second one tells WinBar to ask for confirmation after an attempt to terminate. This confirmation is handy when WinBar is used as the shell and closing WinBar will shut down the Windows session.

If you check the third check box, WinBar uses more system resources to improve its performance. Users with fast machines (50-MHz 486s or better) will probably be satisfied without this improvement, but those with slower machines may like to trade some system resources for the instant response that checking this box will provide. The amount of additional resources used depends on the complexity of your WinBar menus. If you experience low-resource problems with WinBar running, make sure this check box is clear.

Here's how you configure the WinBar menus: Select the Programs submenu in the list box and click on the Edit button to bring up the Edit Bar Field dialog box. This dialog box controls the look and action of a field on the bar. A field can be displayed as text, an icon, the current date, or the current time. It is important to understand that a field's appearance is not related to the action of the field.

The radio buttons along the left of the dialog box control the appearance. With the Text button selected, the Properties box contains a field to enter text for the button. Placing an ampersand (&) in front of a letter in the text field makes that letter an accelerator when combined with the Alt key. For example, the ampersand in front of the P in the Programs menu makes Alt-P the accelerator for this field.

Selecting the Icon radio button changes the contents of the Properties section of the dialog box to an Icon display with a button to change the icon. Before changing the icon, try selecting the Icon button and click OK. You will see the bar change, with the Programs field now represented by the WinBar icon. Clicking on the Edit button will redisplay the Edit Bar Field dialog.

Clicking on the Set Icon button will display the Select Icon dialog box. This box is similar to the Set Icon dialog box in Program Manager, but with one enhancement. Instead of an edit field for entering the icon file's name, there is a combo box that lists default files containing icons. Initially this list contains only PROGMAN.EXE and MORICONS.DLL, each of which offers a good selection of icons. Of course, you can enter your own icon filename or use the Browse button to locate an icon file. Clicking on the OK button selects the icon to use in the field. The Cancel button aborts the selection. Both these buttons close the Set Icon dialog box and return you to the Edit Bar Field dialog.

Selecting the Special radio button replaces the Icon controls in the Properties box with a combo box that lists special display types: the date, the time, or a separator. The separator puts a small block with no text between fields on the bar.

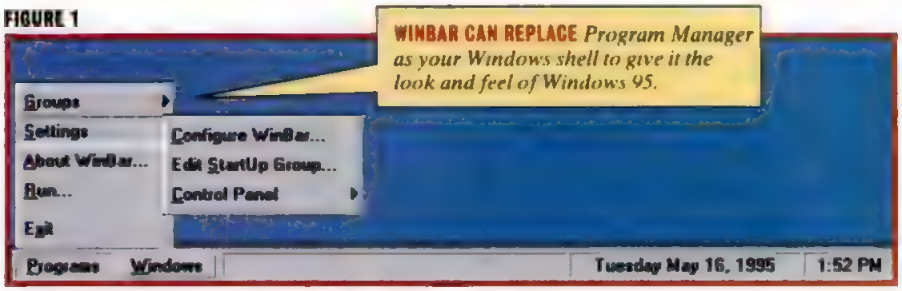
Below the Properties area in the dialog box is an area called Action. The Action area has a Display Menu Edit button for setting the action that occurs when you click on the field. Clicking on the Edit button displays the Edit Action dialog box, which is the most complicated but powerful dialog box in the program.

The Edit Action dialog box is composed of a set of radio buttons along the left, a Properties area in the center, and a set of buttons along the right side (see Figure 2). As with the Edit Bar Field dialog box, selecting the different radio buttons changes the contents of the Properties box.

A field on the bar or an item in a menu can perform one of four actions: display a submenu, launch a program, open a control-panel applet, or perform one of a set of internal WinBar commands. Because in this example we are editing the Programs menu, the Properties dialog box contains a list box with the contents of the Programs menu. The dialog box for editing a menu looks similar to the Configure dialog box. It contains a list of the contents and a set of buttons: Add, Edit, Cut, Copy, and Paste. Select a menu item in the list and click the Edit button to display another Edit Item dialog box to edit this item. You can continue this process in order to navigate through the levels of submenus that you have created.

Select the Program radio button to change the contents of the Properties area so that you can enter the details of a program to launch. Notice that you can set the working directory, the icon for DOS programs, and a hotkey for the program, just as you can in Program Manager. You can also specify that a program be started maximized, minimized, or in a sizable state.

FIGURE 1



WINBAR CAN REPLACE *Program Manager as your Windows shell to give it the look and feel of Windows 95.*

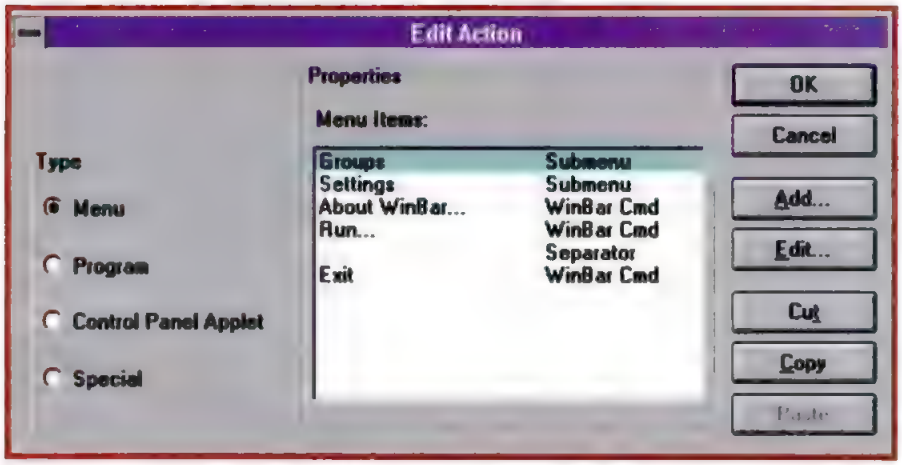


FIGURE 2: *The Edit Action dialog box is the most complicated but also the most powerful dialog box in WinBar. It lets you set the action that occurs when you click on a field.*

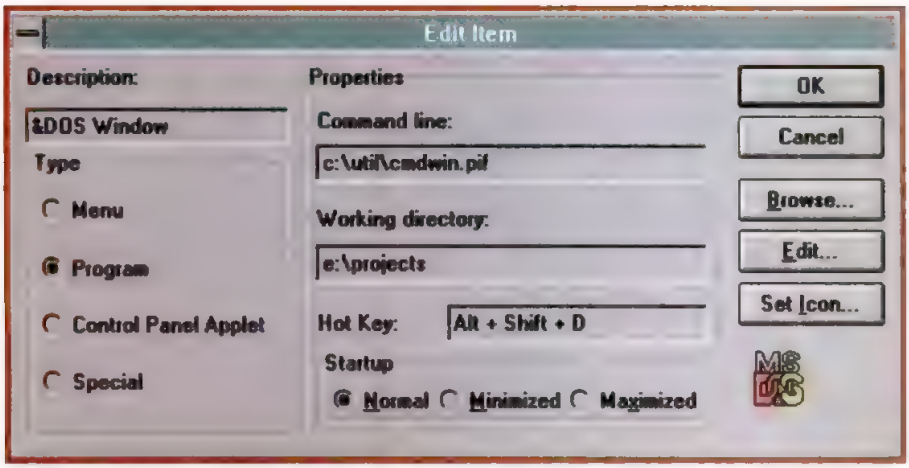


FIGURE 3: *When the Program radio button is selected, the Properties area of the Edit Item dialog box displays the controls necessary to collect program launch data.*

Notice too that the buttons along the right side change with the selection of radio buttons. When you select Program from the radio buttons on the left, the buttons let you browse to find the program file and set the icon of a DOS program. When you have selected a .BAT or .PIF file, the Edit button is enabled. If you have selected a .PIF file, the Edit button launches the PIF Editor so you can change the .PIF file settings when setting up the item. If you have selected a .BAT file, the Edit button launches NotePad.

Selecting the Control Panel radio button changes the contents of the Properties area to a combo box that lists all the available Control Panel applets. By default, a menu of Control Panel applets is contained in the Settings menu, but you can add a Control Panel applet anywhere in the program as a menu item or as a field on the bar.

When you add a program that changes the makeup of the Control Panel, the new applet will be detected the next time you start WinBar and will be included in the Control Panel list. But you must manually add a menu item for this new applet if you want it to be listed on a WinBar menu.

The final radio button, Special, lets you insert a separator in a submenu or have a field or a menu item perform one of the internal WinBar commands. The internal commands let you display the Configure, Edit Startup, Run, and About dialog boxes as well as a command to exit WinBar. There is also a command to display a menu listing the top-level windows on the desktop. Use of the Window List will be discussed shortly.

All of these options make WinBar highly configurable. You can configure a field on the bar or an item in a menu to perform almost any action. When used with a Windows scripting program such as WinBatch or my own WinCmd, a WinBar menu item can do almost anything!

Notice that you can cancel any of these changes by clicking on the Cancel button. The OK button locks in the changes. To be fail-safe, changing an item deep in a set of submenus requires that you click on the OK button for all dialogs up to and including the Configure dialog to lock in changes.

Describing the Configure dialog box and the dialog boxes below it makes WinBar sound pretty complex. Actually, just a little time with the dialog boxes should give you the experience necessary to set up WinBar just the way you want. For WinBar to be as flexible as it is, its configuration dialog boxes are necessarily complex. The rest of the program is much simpler.

The Edit Startup dialog box contains a list of the programs in your Startup group. You can edit and add to this list in two ways. You can click on the Add button or you can select a program in the list and click on the Edit button. Only program items can be added to the Startup group. Note that once the Startup group migrates from Program Manager's group files, the two are completely separate. Changes in one do not affect the other. Also, WinBar's Startup group is relevant only when you use WinBar as the Windows shell. When WinBar is run as a conventional program rather than a shell, it does not launch the programs in its Startup group.

The final item in the Configure menu is a submenu listing the Control Panel applets that were available when WinBar was first installed. Click on any of these items to launch the corresponding Control Panel applet just as if you had started Control Panel and double-clicked on that applet's icon.

Our tour of the Programs menu has now brought us to the last few items on the menu. Clicking on the Run. . . menu item displays the Run dialog box, which is similar to the like-named dialog box in Program Manager. The only difference is that your previous commands are saved in the displayed combo box. The combo box acts as a simple command stack so that you can recall frequently used commands. When WinBar runs out of space for new commands, old commands are dropped.

The About. . . menu item displays WinBar's About box, which includes information about the program such as copyright data, the author's name, and the program's version number. Clicking on the dialog window or pressing Enter or Esc will close this dialog.

Finally, the Exit menu item closes WinBar. If you have the Confirm on Exit check box checked in the Configure dialog, a confirmation dialog will be displayed to confirm the exit command.

The only other action field on the bar is the Windows menu, which contains a list of the windows on the desktop. Click on any of these items to bring a window to the foreground. This is the default action, but you can reconfigure WinBar to behave differently.

The Win 95 Taskbar provides a function similar to WinBar's Windows menu, but does it differently. The Taskbar displays separate buttons along the bar for each top-level window. In the Win 95 beta, the problem with this approach was easy to see. If you have many processes running, too many buttons are crowded onto the bar. I used a menu approach in WinBar to avoid overcrowding.

If you exit WinBar with the Save setting check box checked, WinBar will save its configuration in a file called WINBAR.DAT. This file is saved in the same directory as WINBAR.EXE and holds all configuration data, including the bar and menu structure as well as the font and hotkey values. Like any good Program Manager replacement, WinBar mimics ProgMan in that it saves its configuration if you hold down Shift while attempting to exit WinBar.

THE TOP 10 UTILITIES

1. **FDDLLS** Finds dead DLLs
2. **FINDIR** Analyzes IRQ lines
3. **TAPECA** Windows calculator
4. **WTIME** Keeps PC clock accurate
5. **PLICON** Places program icons
6. **SCHED** Runs programs automatically
7. **MYGRPS** Customizes group icons
8. **QUIKCO** Copies disks in one pass
9. **WINCMD** Command file interpreter
10. **ALLPAP** Customizes bitmapped images

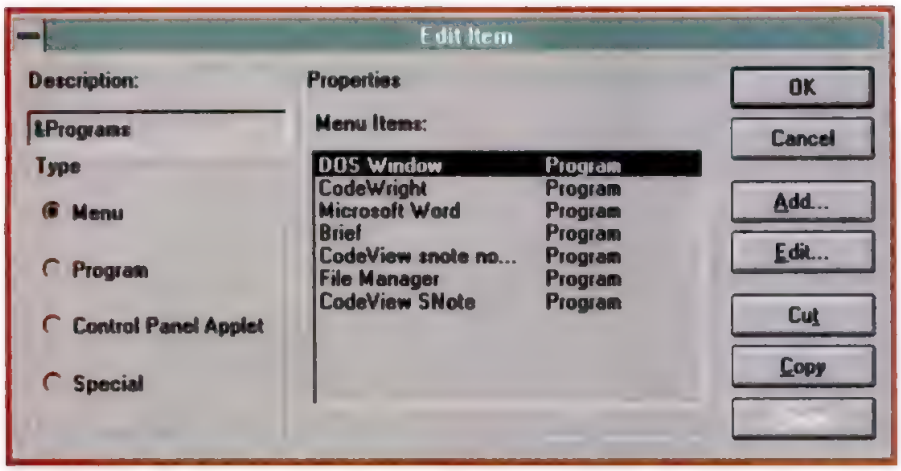


FIGURE 4: *When the Menu radio button is selected, the Properties area of the Edit Item dialog box is transformed to contain a list of the items in the submenu being edited.*

PROGRAMMING WINBAR

WinBar is implemented using a much-enhanced version of a status bar control I have been using in my utilities for more than a year. The most important enhancements are support for buttons and menus on the bar. With the enhanced status bar code, all the main program needs to do is create a window for the status bar to reside in and create menus and buttons on the bar to match the user's configuration.

WinBar is essentially a program launcher. Open a menu and click on an item and WinBar launches a program. But while the concept of WinBar is simple, the implementation is a bit more involved. First, standard Windows menus are too large for a program such as WinBar, where there can be levels within levels of menus. Second, the amount of data that needs to be collected in the dialog boxes is so large that much programming effort was spent conserving dialog box real estate. The menu problem was solved with a rarely used technique: owner-drawn menus. The dialog box problem was avoided using a Windows 3.1 version of the "tabbed" dialog boxes used by OS/2's Workplace shell and Windows 95.

The key to the WinBar look is the owner-drawn menus. When I decided to create a Taskbar for Windows 3.1, the thought of using the clunky two-dimensional Windows 3.*x* menus was very unappealing. Also, it was clear that the heavily nested menu structures that WinBar needs to support would quickly fill up the screen if standard menus were used. Owner-drawn menus was the clear solution. With owner-drawn menus, I could control not only the look of the menus but also their size and, more precisely, their height.

The decision to use owner-drawn menus freed me from the limits of the Windows 3.*x* menu look. Instead of the standard two-dimensional look, why not a more modern three-dimensional look like the menus in OS/2 Warp or Windows 95? The look of the WinBar menus is sort of a cross between the Warp and Win 95 menus.

I incorporated the same beveled look used to create the fields in the status bar control for each item in the menu. When an item is not selected, only the left and right sides are sculpted, making the menu look like one block rising out of the screen. When an item is highlighted, a dark band is drawn at the upper edge of the item and a light band is drawn at the lower edge. This makes the highlighted item appear as if it is indented into the menu.

Implementing owner-drawn menus is similar to using owner-drawn list boxes or combo boxes. Just as with any owner-drawn control, you specify that the items are to be owner-drawn. The window owning the control then receives WM_MEASUREITEM and WM_DRAWITEM messages to provide dimensions and draw the items in the control.

WinBar responds to a MEASUREITEM message by returning the width and height of the string contained in the menu item. The dimensions of a string in Windows can easily be computed with the GetTextExtent API function. The DRAWITEM messages are processed by drawing the appropriate beveling around the edge of the menu item and then writing the text out with the DrawText API function.

> When an owner-drawn WinBar menu item is not selected, only the sides are sculpted, making the menu look like one block rising out of the screen.

DrawText is used instead of the other text-out functions because it automatically converts each ampersand-plus-letter string into an underlined character to indicate an accelerator key.

There are a few problems with owner-drawn menus. As with the other owner-drawn controls, you can provide a 32-bit user-defined value to Windows for each item in the menu. This value, typically a pointer to data relevant to the specific menu item, is then returned to the program when the WM_MEASUREITEM and WM_DRAWITEM messages are received. The problem is that unlike with owner-drawn list boxes or combo boxes, the 32-bit pointer can be retrieved only when the program is processing the measure and draw messages.

This lack of a method to query the user-defined data creates problems when processing menu selections. When a menu item is selected, a WM_COMMAND message is sent with the ID number of the menu item. The problem is that there is no way to retrieve the user data for the item just selected. The workaround is to have some relationship between the menu ID and the user data associated with the item.

WinBar's problem is even more acute, because all its menus are configurable by the user and dynamically created when the menu is activated. When WinBar creates a menu, the ID number it assigns to a menu item is the count of the menu item as it's added to the menu structure. The IDs are consecutively assigned to each menu item and all submenus in the menu. When a WM_COMMAND message is received, WinBar uses the ID as an index into the memory structure that contains the data for each menu item. By tracing through the menu structure, WinBar can convert the ID number into the pointer to the data block for the appropriate menu item.

Another problem with owner-drawn menus is that unlike the case with standard menus, Windows provides no built-in support for accelerator keys. If you implement an owner-drawn menu, you must also provide some method for relating keystrokes received while the menu is active to the menu items in the menu. While the DrawText function knows about the leading ampersand character and automatically underlines the next character, it does not help with detecting the key itself.

Windows does supply some support through the WM_MENUCHAR message. When a menu is open and a user presses a key, Windows sends a WM_MENUCHAR message to the window that owns the menu. The wParam value of this message contains the ASCII character from the key. The lParam value contains the open menu's handle and a flag indicating whether the menu is a pop-up or a system menu. A window can respond to a WM_MENUCHAR in one of three ways. The

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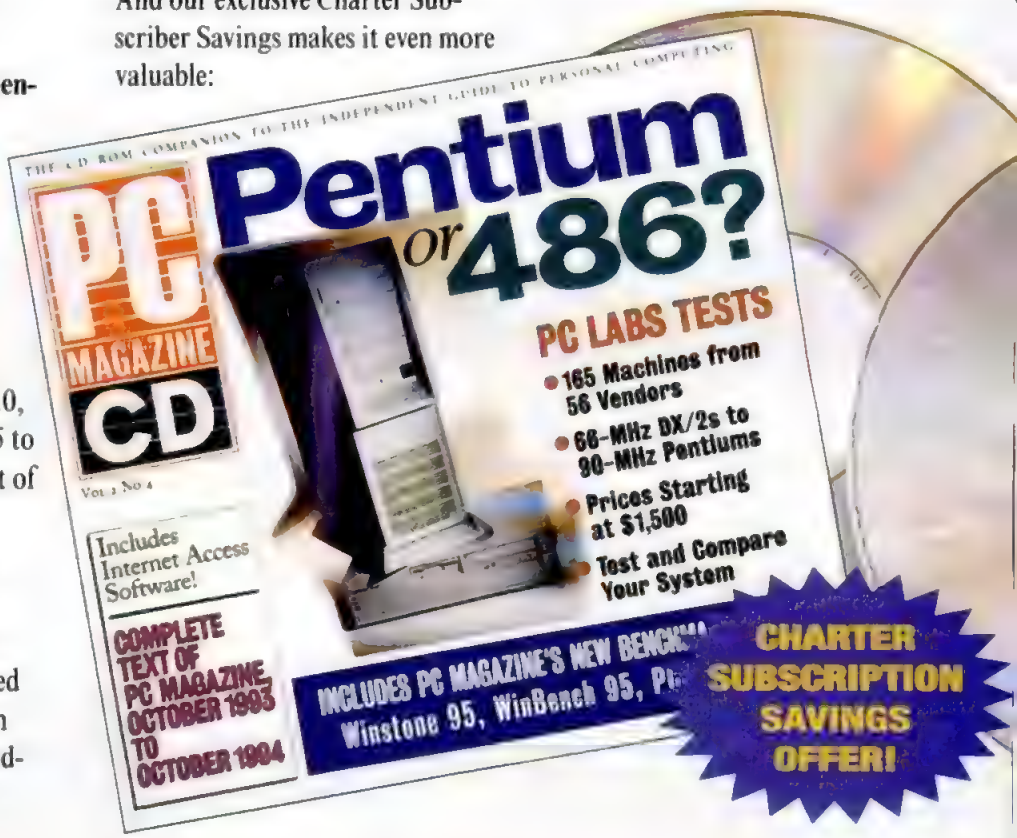

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window can instruct Windows to ignore the key, tell Windows to close the menu, or inform Windows of the menu item corresponding to the pressed key. The default behavior is to beep and ignore the character.

WinBar uses the WM_MENUCHAR message along with an array of structures containing the menu accelerator keys (more properly called *access keys*) for the active menu. WinBar initializes this structure when it creates a menu by scanning the text for each menu item to find the leading ampersand character indicating an access key. Each entry in the key structure is then filled with the key along with the handle of the menu containing the access key. This key-plus-menu-handle combination keeps each access key unique even if the same key is used within multiple submenus in a menu.

If you have implemented owner-drawn list boxes or combo boxes, owner-drawn menus are not that much of a leap. The main problem is determining the user-defined pointers in each menu item outside of the WM_MEASUREITEM and WM_DRAWITEM messages. Once you overcome that problem and menu access keys are implemented, owner-drawn menus provide a method for implementing your own look to a program. With the new look of Windows 95, I expect to see a number of programs that implement owner-drawn menus on their Windows 3.1 versions so that they have the modern Windows 95 look.

```
//=========================================================
// EditItemDlgProc - Item Edit dialog box dialog procedure
//=========================================================
BOOL CALLBACK EditItemDlgProc (HWND hWnd, UINT wMsg,
                               UINT wParam, LONG lParam) {

   switch (wMsg) {
   case WM_INITDIALOG:
      // If editing startup item, hide icon ctls that are
      // normally hidden by sheet change code.
      ShowWindow (GetDlgItem (hWnd, IDD_ICONFNAME),
                  SW_HIDE);
      ShowWindow (GetDlgItem (hWnd, IDD_ICONINDEX),
                  SW_HIDE);

      // Default to normal launch for program
      CheckRadioButton (hWnd, IDD_RF1, IDD_RF3, IDD_RF1);

      // Activate proper menu type controls
      if (lParam) {
         // Init menu name control
         SetDlgItemText (hWnd, IDD_ITEMNAME, (LPSTR)lParam);

         switch (*(LPWORD)lParam) {
            case MTYPE_SUBMENU:
               //
               // Init submenu controls
               // .
               // .
               // .
               PostMessage (hWnd, WM_COMMAND, IDD_TMENU, 0);
               break;

            case MTYPE_PROG:
               //
               // Init program controls
               // .
               // .
               // .
               PostMessage (hWnd, WM_COMMAND, IDD_TPROG, 0);
               break;

            case MTYPE_CPL:
               //
               // Init control panel controls
               // .
               // .
               // .
               PostMessage (hWnd, WM_COMMAND, IDD_TCPL, 0);
               break;

            default:
               //
               // Init internal comamnd controls
               // .
               // .
               // .
               PostMessage (hWnd, WM_COMMAND, IDD_TSPEC, 0);
               break;
         }
      } else {
         SetWindowText (hWnd, "Add Item");
         // Default to adding program
         PostMessage (hWnd, WM_COMMAND, IDD_TPROG, 0);
      }
      return rc;

   case WM_COMMAND:
      // If radio button change, show and hide proper
      // controls
      if ((wParam >= IDD_TMENU) && (wParam <= IDD_TSPEC)) {
         if (IsDlgButtonChecked (hWnd, wParam) == 1)
            return 0;
         CheckRadioButton (hWnd, IDD_TMENU, IDD_TSPEC,
                           wParam);
         // Hide all property controls
         for (i = IDD_LISTT; i < IDD_SPECTYPE+1; i++)
            if (hCtl = GetDlgItem (hWnd, i))
               ShowWindow (hCtl, SW_HIDE);
      }
      // Now switch on control causing WM_COMMAND
      switch (wParam) {
         //
         // The following 4 controls are radio buttons.
         // Show approperate controls depending on which
         // radio button was clicked.
         //
         case IDD_TMENU:
            // Show sub menu controls
            for (i = IDD_LISTT; i < IDD_PASTE+1; i++)
               if (hCtl = GetDlgItem (hWnd, i))
                  ShowWindow (hCtl, SW_SHOW);
            break;

         case IDD_TPROG:
            // Show program controls
            for (i = IDD_CMDT; i < IDD_BROWSE+1; i++)
               if (hCtl = GetDlgItem (hWnd, i))
                  ShowWindow (hCtl, SW_SHOW);
            // Force icon set
```

FIGURE 5: *This is a highly simplified version of the dialog box procedure that controls the Edit Item dialog box.*

DIALOG-BOX REAL ESTATE

Another area of interest to Windows programmers is the technique used in WinBar to conserve dialog-box real estate. The problem is most apparent in WinBar's Edit Item dialog box, which gathers data for new or edited menu items. The problem arises because a menu item can produce one of a number of different actions, with each action needing different initialization data.

For example, launching a program requires the command name, the working directory, a hotkey value, and, for a DOS program, an icon. If the menu item is to contain a submenu, however, the initialization data is completely different. The dialog box must contain a list box with the submenu items along with controls for manipulating the list.

Windows 95 and OS/2 Warp solve this problem by using a tab control that displays controls only when necessary. Programs written in MFC (Microsoft Foundation Classes) and Borland's Delphi can use tab controls in Windows 3.1, since those languages provide a tab control. Because WinBar is written in C without any class libraries that offer tab controls, it uses radio buttons to select the modes and then manually sets which controls are displayed at any one time.

Figure 3 shows the Edit Item dialog box with the Program radio button selected. In this case, the Properties area contains the controls necessary to collect program launch data.

```
      PostMessage (hWnd, WM_COMMAND, IDD_ICONPICT,
                   0);

      // Force icon set and edit bat button enable
      PostMessage (hWnd, WM_COMMAND, IDD_CMD,
                   MAKELPARAM (0, EN_KILLFOCUS));
   break;

case IDD_TCPL:
   // Show control panel controls
   for (i = IDD_CPLTYPET; i < IDD_CPLTYPE+1; i++)
      if (hCtl = GetDlgItem (hWnd, i))
         ShowWindow (hCtl, SW_SHOW);
   break;

case IDD_TSPEC:
   // Show internal command controls
   for (i = IDD_SPECTYPET; i < IDD_SPECTYPE+1; i++)
      if (hCtl = GetDlgItem (hWnd, i))
         ShowWindow (hCtl, SW_SHOW);
   break;
      PostMessage (hWnd, WM_COMMAND, IDD_TSPEC, 0);
//
// Submenu Property Controls
//
case IDD_LIST:
   break;

case IDD_ADD:
   break;

case IDD_EDIT:
   break;

case IDD_CUT:
case IDD_COPY:
   return TRUE;

case IDD_PASTE:
   return TRUE;

//
// Program Property Controls
//
case IDD_CMD:
   break;

case IDD_BROWSE:
   break;

case IDD_EDITBAT:
   break;

case IDD_ICONPICT:
   return TRUE;

case IDD_SETICON:
   break;
//
// Dialog box exit (OK and Cancel)
//
case IDOK:
   // See which item type has been selected
   for (i = IDD_TMENU; i < IDD_TSPEC+1; i++)
      if (IsDlgButtonChecked (hWnd, i) == 1)
         break;
      // Switch on item type selected
   switch (i) {
      case IDD_TMENU:
         // Get and validate menu data
         break;

      case IDD_TPROG:
         // Get and validate
         // program data
         break;

      case IDD_TCPL:
         // Get and validate
         // control panel data
         break;
      case IDD_TSPEC:
         // Get and validate
         // internal command data
         break;
   }
   EndDialog(hWnd, 1);
   break;

case IDCANCEL:
   // See if changed.  If so, verify cancel
   // with user
   EndDialog(hWnd, 0);
   break;
  }
  return TRUE;
 }
 return FALSE;
}
```

Figure 4 shows the same dialog box with the Menu radio button selected. In this particular case, the Properties area contains a list of the items in the submenu being edited. The key is that both figures show the same dialog box.

Figure 5 contains a highly simplified version of the dialog box procedure that controls the Edit Item dialog box. The procedure works by selectively showing some controls in the dialog box and hiding others, depending on the radio buttons set. Notice that in the WM_INITDIALOG procedure, lParam is used as a pointer to any initialization data. The data contains an sType field that indicates the type of field being edited. The procedure initializes the proper controls depending on the type of data being edited. At the end of initialization for each type, the procedure posts a WM_COMMAND message to itself to simulate a click on the radio button necessary to show the proper set of controls.

When a WM_COMMAND message is received, it is first checked to see if one of the radio buttons has been clicked. If so, all controls that are type-specific are hidden, and the proper radio button is selected. Then, using the standard switch statement found in most WM_COMMAND processing, action is taken for the proper control. In the case of the radio buttons, the procedure responds by making visible the controls specific to the type of item being edited.

Finally, when a WM_COMMAND message is received from the OK button, the procedure checks to see which radio button is checked and gathers the data from the appropriate controls. While eliminated from this example for simplicity, error-checking code in WinBar verifies the data from each of the controls as it is gathered.

Another interesting point is how WinBar uses the IDD_ICONFNAME and IDD_ICONINDEX controls. These controls are hidden during the WM_INITDIALOG message and never made visible. They are used to store the name and the icon index of the file containing the icon to be used. These controls are never seen by the user, since the icon information is queried with the Set Icon dialog box.

While using static variables to save the values might seem easier, that is not possible in WinBar. Since WinBar recursively creates Edit Item dialog boxes, any static data from one dialog box would be overwritten by another instance of the dialog box. The controls, on the other hand, are created for each unique instance of the dialog box, so no conflict occurs.

WinBar demonstrates that while the user interface of Windows 95 is a vast improvement over Windows 3.1, there is nothing to prevent programmers from implementing the new interface in Windows 3.1. Windows 95 contains many other new features, of course, but many new user interface features can be added to Windows 3.1 by third parties. No need to wait for those third parties to get into the act. Enjoy Win 95 interface features now with WinBar. □

GUIDE TO OUR UTILITIES

ABOUT WINBAR...

DESCRIPTION WinBar is a highly configurable rendition of the Windows 95 Taskbar that runs under Windows 3.1. It can launch programs either from its menu structure or from an icon. WinBar can replace Program Manager as your Windows shell.

SETUP To install WinBar, copy the files WINBAR.EXE and WBDLL.DLL to a directory on your hard disk and run WINBAR.EXE. Start WinBar using the File | Run menu item in Program Manager.

When WinBar is first run, it will copy information from Program Manager's group files to initialize its menus. To configure WinBar, select its Programs | Setup | Configure menu item. Use the series of nested dialog boxes to edit the current menus and to add new menus or individual items. The Load Groups button in the Configuration dialog box can be used to copy group information from Program Manager to a WinBar menu.

REMARKS To use WinBar as the Windows shell, change the SHELL= line in the [boot] section of SYSTEM.INI to the fully specified WinBar filename. The file WBDLL.DLL must be in the Windows directory if you use WinBar as the Windows shell.

The WinBar Startup group is relevant only if WinBar is used as the Windows shell. Changes made to WinBar's Startup group are not reflected in Program Manager's Startup group.

WinBar stores its configuration information in the file WINBAR.DAT, located in the same directory as WINBAR.EXE.

FILES WINBAR.EXE—A self-extracting archive containing only what's necessary to run the utility, WINBAR.EXE and WBDLL.DLL. WINBAR.DOC—The documentation file, which you can view on-line. WINBAR.ZIP—The WinBar program, documentation, and source files.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Watching the Windows 95 Boot-Up Sequence

I recently installed the Windows 95 final beta release over an old, highly customized version of Windows 3.11. Some of the installed devices were not automatically recognized, and I was annoyed by the way Windows 95 hides the entire loading of CONFIG.SYS and AUTOEXEC.BAT behind a lovely Microsoft curtain.

By trial and error, I found a way to open the curtain: Simply hit the Esc key when the Windows 95 loading message appears, and you get exactly what you're used to: plain DOS text. I hope this will help others to see what happens when their resident DOS drivers try to load.

CHRISTIAN RENARD, Liege, Belgium

PC MAGAZINE: If you want to keep the gory details of the boot process hidden by default, and reveal them only when you need to see them, this is the way to go. Press Esc when you see the logo screen and you'll drop back to the text-based world of CONFIG.SYS and AUTOEXEC.BAT. If you'd prefer to eliminate the logo screen entirely, you can edit MSDOS.SYS. (Don't worry—in Windows 95 MSDOS.SYS is a read-only, hidden text file.) This MSDOS.SYS file is structured like a Windows .INI file. Remove the read-only and hidden attributes, add the line Logo=0 to the [Options] section, and restore the read-only and hidden attributes. Now the Windows 95 logo will not appear at start-up.

For an even more detailed view of the boot process, press F8 immediately after the "Starting Windows 95..." message appears. This will bring up a menu of start-up options, including "Step-by-step confirmation." Select this option and you can step through CONFIG.SYS and AUTOEXEC.BAT one line at a time, accepting or rejecting each line. You'll have all the time you need to peruse any start-up error messages.

Creating Multiple Subdirectories at Once

Suppose a batch file installation program instructs a user to enter the name of a directory where an application should be installed. If the user enters directory \A\B, there are three possible results:

- *Directory \A\B exists; the program then copies the files into that directory.*
- *Directory \A exists; the program creates directory \A\B and then copies files.*
- *Directory \A does not exist; the program halts and sends a message that it can't create directory \A\B.*

That third possibility is a problem: The installation can't continue, because a directory can be created only in an existing directory. But we can solve the problem: We need to check the directory one level above the requested directory. If this directory does not exist, we note that it will have to be created; then we check whether the directory one level above it exists and repeat the procedure. At some point we reach an existing directory, even if it's the root directory (\), which always exists. Then the directories we noted must be created, but in the opposite order.

This is essentially what CREATDIR.BAT (Figure 1) does. It checks the existence of a directory by testing whether the NUL device exists in the directory. Every time the test returns a negative result, CREATDIR appends "\.." to the test path and uses this path in the next round. With some clever copying, it's possible to ensure that the last MD dir command is written at the beginning of the new batch file that CREATDIR builds. When an existing directory is reached, this new batch file is called and it creates the missing directories.

The procedure can correct some typing errors. For example, if the user specifies \A\B\\C as the directory name, \A\B\C will be created. But if the user appends \ to the final directory (\A\B\C\), all directories except the last one will be created.

The fact that the batch file works only with DOS versions above 3.30 is not a serious limitation today, but environment space may be a problem. If the message "Out of environment space" appears, you'll need to increase environment space in the CONFIG.SYS file. Otherwise all the regular DOS file limitations apply (the name length, allowed characters, and so forth).

MIRAN ZELJKO, Ljubljana, Slovenia

PC MAGAZINE: This remarkable batch file takes advantage of the way DOS resolves the double-dot (..) reference to a parent directory. The directory name C:\ANYTHING\.. resolves to C:\ regardless of whether C:\ANY-

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PC DIRECT

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```
@echo off
    if %1.==. goto help
    if exist %1\nul goto existd
    if exist %1 goto existf
    set dirr=%1
    rem > creatdil.bat

:back
    echo md %dirr% > creatdir.tmp
    copy creatdir.tmp+creatdil.bat > nul
    copy creatdir.tmp creatdil.bat > nul
    set dirr=%dirr%\..
    if not exist %dirr%\nul goto back
    call creatdil
    del creatdil.bat
    del creatdir.tmp
    if exist %1\nul goto ok
    echo Directory %1 could not be created
    goto end

:ok
    echo Directory %1 created
    goto end

:existd
    echo Directory %1 already exists
    goto end

:existf
    echo File %1 already exists
    goto end

:help
    echo Enter command together with
    ➥directory name, e.g.:
    echo.
    echo       %0 \A\B\C\D\E

:end
    set dirr=
```

FIGURE 1: *CREATDIR.BAT creates a multilevel directory such as C:\A\B\C.*

THING is an existing directory. The name C:\FOO\BAR\..\.. again resolves to C:\ even if C:\FOO or C:\FOO\BAR does not exist.

CREATDIR.BAT repeatedly adds "\.." to the requested directory name until it reaches a directory that does exist. It also relies on the fact that in ordinary MS-DOS the test "IF EXIST dirname\NUL" returns True if and only if dirname specifies an existing directory. There are a number of DOS variants in which this test always returns True, even for nonexistent directories. CREATDIR.BAT will not work under these variants, which include DR-DOS 6.x, MS-DOS under Windows for Workgroups with 32-bit file access enabled, and many network operating-system add-ons.

This batch file has one serious flaw. If the passed directory is not a valid DOS directory name—"C:\A.A.A\B\C\D", for example—it will never represent an existing directory no matter how many times "\.." is appended, so CREATDIR.BAT will loop indefinitely. I worked up a two-part version of CREATDIR.BAT that rejects invalid directory names and succeeds even when the directory name ends in a backslash. As a side benefit, this version uses no environment space.

Believe it or not, all the actual work is done by the tiny recursive batch file DCREAT.BAT (Figure 2). If the name passed to it doesn't exist, DCREAT.BAT calls itself, passing the name with "\.." appended. This process repeats, stacking up instances of DCREAT.BAT in memory until it reaches a directory that does exist. At that point, the third line of each instance of DCREAT.BAT gets executed, starting with the last instance and ending with the first. The result is that the desired directory gets built one level at a time. When DCREAT.BAT calls the MD command to create a directory, it appends "\.". This allows DCREAT.BAT to create a directory that ends with a final backslash.

DCREAT.BAT has no error handling at all, however, and it makes the dangerous assumption that you've passed it a valid directory name. DIRCREAT.BAT (see Figure 3) is a "wrapper" for DCREAT.BAT that handles all necessary error checking. As with the original CREATDIR.BAT, it checks that the requested name isn't an existing directory or an existing file. It also checks to be sure the directory name is valid.

Determining whether the requested directory is valid without actually creating it is a tough task; the undocumented TRUENAME command handles the job. TRUENAME, introduced in DOS 4.0, takes a filename and returns the corresponding full pathname. As long as the filename is valid under DOS, TRUENAME will process it; the file does not have to exist. DIRCREAT uses this fact to test whether the passed directory is valid. It pipes the output of TRUENAME through the FIND filter, looking for the colon (:) that's part of any full pathname. The CTTY NUL command before TRUENAME suppresses any error messages; CTTY CON afterward restores normal output. If the colon was not found, FIND sets DOS ERRORLEVEL to 1 and the batch file reports an invalid directory name.

```
IF EXIST %1\NUL GOTO End
CALL %0 %1\..
MD %1\.
:End
```

FIGURE 2: *This tiny recursive batch file creates a multilevel directory, but it doesn't include error checking.*

If the passed parameter gets through this gauntlet of tests, it's a valid directory name that does not represent an existing directory or file. DIRCREAT.BAT calls on DCREAT.BAT to do the actual work and then reports its success.

DIRCREAT.BAT can create almost any multilevel directory. The one limitation is this: The sum of the requested directory's length and three times the number of directories to be created must not exceed 105. That's not much of a limitation! You can create a multilevel directory of the maximum length (66 characters including the drive letter) as long as no more than 13 subdirectories need to be created. In normal usage, you'll never come anywhere near this limit.

```
@echo off
    if %1.==. goto help
    if exist %1\nul goto existd
    if exist %1 goto existf

    CTTY NUL
    TRUENAME %1 | FIND /i ":"
    CTTY CON
    IF ERRORLEVEL 1 GOTO BadName

    CALL DCREAT.BAT %1
    IF EXIST %1\NUL ECHO Created %1
    IF NOT EXIST %1\NUL ECHO Failed to
    ➥create %1
    goto end

:existd
    echo Directory %1 already exists
    goto end

:existf
    echo File %1 already exists
    goto end

:badname
    echo %1 is not a valid directory name
    goto end

:help
    echo Enter command together with
    ➥directory name, e.g.:
    echo.
    echo       %0 \A\B\C\D\E

:end
```

FIGURE 3: *DIRCREAT.BAT includes all the error checking needed by DCREAT.BAT; it calls DCREAT.BAT only if the requested directory is valid.*

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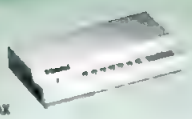

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CIRCLE 062 ON READER SERVICE CARD

Ask Our Advisors

HARDWARE

This Call's for Me!

When my phone rings, my computer grabs the line before I can answer, and the caller gets a fax tone. I'm running Windows for Workgroups, WinFax PRO 4.0, and QuickLink II, with the latter two programs set to pick up after four rings. Do you have any suggestions?

ROY LEE, via ZiffNet

PC MAGAZINE: It's possible that your modem is configured to answer the phone automatically. There is no single command set for modems (even for those that claim to be "Hayes-compatible"), but here's how to check the setting of most modems and change it if necessary.

Start up a simple telecommunications program in terminal mode; Windows Terminal will do. Start by typing "AT" (in capitals, without the quotes), then press Enter. If you get an "OK" message, you'll know that you are communicating with the modem. (If not, you may have to adjust the COM port and speed settings for the terminal program.)

You can get most modems to list all their settings by sending the "AT&V" command. The specific setting you need here, however, is the S0 register. To find the contents of this particular register, use the "ATS0?" command. The modem should answer with a three-digit value, which represents the number of rings the modem will wait for before answering the phone. If this number is zero (000), then the modem will not answer the phone. If the result is anything other than zero, you can use the command "ATS0=0" to change this setting. The command "AT&W0" will store this change in the modem's configuration.—*Alfred Poor*

Upgrade Acceleration?

I have a 16-MHz 386 system, and I'm wondering whether a memory manager would be useful to try to speed up my machine's sluggish performance. Switching to DOS 6.2 helped some but not enough. Would a memory manager provide the necessary boost?

JOHN PETERSON, via the Internet

PC MAGAZINE: The main function of memory managers is to let you move drivers and other code into high memory, giving you more available system memory below the 640K barrier. While this can have an impact on performance, you're more likely to get a bigger performance increase with other types of upgrades.

If you're on a limited budget, first consider upgrading the CPU. You could add a 486-DX/33 for less than $100. Do check your machine's documentation, however, and if necessary contact the manufacturer to ensure that your current motherboard can take a faster 486 chip and that your memory will support the faster speed. If your memory won't support the faster speed, you can replace the motherboard with one containing a faster 386 processor, a 386DX/40, for example. Finally, if you're running Windows and have less than 8MB of memory, bring your total memory up to 8MB. You should be able to do this for less than $40 per MB. Any of these approaches should give your system's performance a noticeable boost.—*Alfred Poor*

Bus Blues

A friend just bought an 80-MHz DX2 motherboard with a VESA bus, then couldn't find a VESA VGA card that would work with it. I'm planning to swap my motherboard for a DX4/100 model, but I'd hate to experience the

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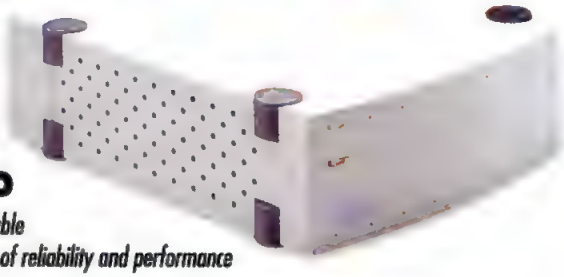

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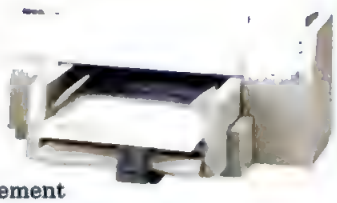

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same problem. I assume that PCI is just for Pentiums, but I'm not ready to go that route at this point.

GLENN DOES, via ZiffNet

PC MAGAZINE: You shouldn't experience the same problems your friend did, because your system will actually place less of a demand on VL-Bus performance than his.

The DX2/80 has a clock-doubled design, which means that the system bus operates at a 40-MHz rate. While the VL-Bus specification does support expansion slots at this rate, the slots must be buffered to operate at this speed. Most inexpensive motherboards do not have buffered VL-Bus expansion slots, and VL-Bus expansion cards generally will not work at system bus speeds higher than 33 MHz (which is the limit for unbuffered VL-Bus slots). The 40-MHz system bus speed is the most likely culprit in your friend's tale of woe.

Even though your proposed system is faster than your friend's, your system bus will be within the specification limits. This is because the DX4/100 is a clock-tripled processor. Since the system bus will run at 33.3 MHz, you should not experience any problems with VL-Bus expansion cards.

If you do go with a Pentium CPU, you should definitely favor the PCI bus over the VL-Bus. The PCI bus uses its own clock speed and is separate from the processor, making it better suited for the faster clock speeds of the Pentium chips. In spite of plummeting prices, a Pentium PCI motherboard still costs two or three times as much as an equivalent DX4 VL-Bus motherboard, so if cost is a concern, the DX4 VL-Bus continues to be a cost-effective route for those who want better performance at a bargain price.—*Alfred Poor*

Power Trip, Part Two

Your recommendation in the issue of March 28, 1995, to use a single power strip to control all computer peripherals ignores one important exception: ink jet printers. Ink jets need to return their print heads to a home position where the ink can't evaporate. If the power is turned off externally, the print head will remain where it is, and the ink can dry and clog the ink jets.

There may be other peripherals with similar power eccentricities that readers should carefully consider when organizing an installation's power feed.

JIM HARWOOD, via the Internet

My Canon BJ200e manual says that the printer should always be turned off by hand, and when I do, it takes a moment to somehow cork the ink jets so that they won't dry and clog. Doesn't the hard disk need time to park as well, or does its circuit retain sufficient power to complete these operations?

JOHN WEST, via the Internet

PC MAGAZINE: Readers Harwood and West both make an excellent point about ink jet printers. In fact, it may be a good idea to leave most printers off the power strip.

The power switch on an ink jet printer would better be described as a "request to power down" switch. When you press it, the printer goes through a series of shutdown steps designed to protect the print head.

You may also want to leave your laser printer off your power strip, but for a different reason. Many lasers draw 500 or more watts of electricity at peak times, and this can exceed the circuit-breaker capacity of some power strips. (You need one amp of rated capacity per 120 watts.) Since more and more laser printers have low-power "sleep modes," keeping them permanently turned on is not the excessive power drain it used to be.

Other components may be sensitive to power-on sequencing as well. I have one computer that initializes its serial ports during the boot procedure, and if the attached modem is powered on at the same time, the computer fails to recognize it. I have to wait until the computer has powered up before I turn on the power to the modem.

The one component that you don't have to worry about, however, is the hard disk. Old drives that used stepper-motor technology for positioning the heads had to be parked before you turned off the power, but modern hard disks use voice-coil technology, which automatically retracts the heads to a safe location when the power is turned off.

So leave ink jet printers off your power strips, check your strip's capacity before adding a laser printer to it, and look out for other devices such as scanners or modems that may want to be turned on before or after your computer.—*Alfred Poor*

OPERATING ENVIRONMENTS

Rebooting in Windows Revisited

The item "An Escape Hatch from Ill-Behaved Windows Apps" (User-to-User, December 6, 1994) recommends including the following in the [386Enh] section of SYSTEM.INI:

```
DebugLocalReboot=TRUE
```

Should this be used instead of the following form described in the Windows SYSINI.WRI file?

```
LocalReboot=<on-or-off>
```

SYSINI.WRI says this line specifies whether you can press Ctrl-Alt-Del to quit applications that cause an unrecoverable error in 386 Enhanced mode without restarting Windows.

TED HARSHAM, via the Internet

PC MAGAZINE: The two lines are related, and several readers wrote to ask about the difference. The documented LocalReboot line is what allows you to press Ctrl-Alt-Del to terminate a crashed program. If you change this line from its default of ON, then pressing Ctrl-Alt-Del will reboot the whole system. The undocumented DebugLocalReboot line takes the same idea one step further. When this line is set to TRUE, you can press Ctrl-Alt-Del to terminate a program that, as far as Windows can tell, has not crashed.

When would you do that? Here's an example from my own experience: A port conflict would occasionally leave my telecommunications software "thinking" it was connected when it really wasn't. The program refused to terminate without hanging up, but there was no way to hang up on the nonexistent connection. Ctrl-Alt-Del was the only way out!

There is one catch, though. When you press Ctrl-Alt-Del to terminate a crashed program, Windows can instantly identify the offender. If you're attempting to terminate a program that Windows doesn't recognize as having crashed, Windows may pick the wrong program. Be sure to actually look at the confirmation screen Windows displays to make sure it is the right program!—*Neil J. Rubenking*

Deleting Files by Date

I currently use an application that archives files into a subdirectory on a daily basis. Each file has a unique name, so it's impossible to delete the files using wildcards. Is there any way to delete files based on their DOS date and time? For instance, could I delete all files with a date prior to a specified date?

ROBERT A. POWELL, JR., via fax

PC MAGAZINE: The closest thing DOS itself has to what you want is the ability to XCOPY files that were created on or after a given date. That's quite a stretch from deleting files created *before* a particular date, but not too far for a batch file to bridge, as Figure 4 shows. DELBEFOR.BAT operates in the current directory and deletes all files created before the date specified on the command line.

To start, the batch file creates a temporary directory with the unlikely name of !@#$$#@!.$$$. It uses XCOPY to copy all files created on or after the specified date to that directory. As a safeguard, if the temporary directory winds up containing no files at all, DELBEFOR won't go any further. The FOR command flips through all files in the current directory, displaying the names of those that are not found in the temporary directory.

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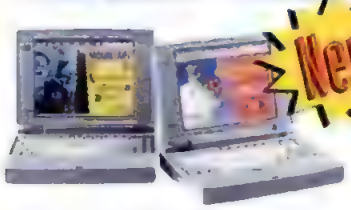

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Versa V	486DX2/50	4MB	9.5" Active	250MB	$2,233
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CIRCLE 272 ON READER SERVICE CARD

```
@ECHO OFF
REM DELBEFOR.BAT - deletes files in the current directory that
REM  are dated before the date specified on the command line.
MD !@#$$#@!.$$$
XCOPY /D:%1 *.* !@#$$#@!.$$$ > NUL
IF NOT EXIST !@#$$#@!.$$$\*.* GOTO Warning
FOR %%v IN (*.*) DO IF NOT EXIST !@#$$#@!.$$$\%%v ECHO %%v will be deleted
FOR %%v IN (*.*) DO IF NOT EXIST !@#$$#@!.$$$\%%v DEL %%v
ECHO Y | DEL !@#$$#@!.$$$ > NUL
GOTO End
:Warning
ECHO.
ECHO Warning: This command would delete ALL files in the current
ECHO  directory. Either all files are earlier than the specified
ECHO  date, or "%1" is not a valid date. No action taken.
:End
RD !@#$$#@!.$$$
```

FIGURE 4: *DELBEFOR.BAT deletes all files in the current directory that were created before a specified date.*

Then another FOR command deletes all files in the current directory that are not found in the temporary directory. Finally, DELBEFOR.BAT clears out the temporary directory and removes it.

If you're working with a lot of files, or with very large files, this method is rather inefficient. You might be better off using DOSSHELL or the Windows File Manager, sorting the files by date, and deleting all those before the cutoff date.—*Neil J. Rubenking*

WORD PROCESSING

Saving All Open Documents in WP/DOS 6.0

Sa ing your work to disk, regularly and frequently, is always a good idea. But if you work with many open documents in WordPerfect for DOS 6.0a, sa ing is not always con enient. WordPerfect lets you keep as many as nine documents open simultaneously, and it's tedious to sa e each one, one at a time. The macro in Figure 5, SAVEALL, automates the process. As its name implies, it lets you sa e all open documents with a single command.

ALAN D. LEGATT, White Plains, New York

PC MAGAZINE: The macro in Figure 5 is less straightforward than you might expect, which is part of what makes it interesting. Here's how it works:

The first line, DISPLAY (On!), tells WordPerfect to display each step in the macro. The next line is the first statement in a FORNEXT...ENDFOR loop. It instructs WordPerfect to repeat each step within the loop for each possible document. More precisely, it defines a variable, Docnum, and tells WordPerfect to repeat the loop for all values of Docnum, starting at 1 and ending at 9, and incrementing by 1 for each step. As the first step in the loop, the SwitchDoc(Docnum) command tells WordPerfect to switch to the document number that matches the current value of Docnum.

The next section of the macro is the unexpected part. The IF statement tests to see if the current document is blank, using the system variable ?DocBlank. If the document is blank, the macro closes it, jumps to the final ENDIF statement, continues to the ENDFOR statement, and then either cycles through the loop again or quits, depending on the current value of Docnum. If the document isn't blank, the macro continues to the second IF statement, which immediately follows the ELSE statement.

Testing for and closing blank documents is an important part of this macro, though the reason is less than obvious. Briefly, if there are fewer than nine documents open, the macro moves through the extra loops anyway until it reaches a Docnum value of 9, and the SwitchDoc(Docnum) statement creates a new blank document for any value of Docnum that doesn't match an already open document. Without the IF statement and Close command, the macro would leave these new documents open. This section of the macro tells WordPerfect to close any blank document it has just created, so you don't end up with a bunch of new, empty documents.

The rest of the macro is straightforward. The second IF statement uses the ?DocModified system variable to test whether the document has been modified since it was last saved, loaded, or created. If so, it issues the save command. If not, it goes directly to the ENDIF and ENDFOR statements. Note that if a given document is unchanged, the macro will neither close it nor waste time saving it.

One shortcoming of SAVEALL is that no matter which document you were working on when you started the macro, when it finishes, the highest-number document becomes the current document. The macro in Figure 6, SAVEALL2, solves that problem by adding two lines—one just before the FORNEXT... ENDFOR loop and one just after. The ASSIGN command just before the FORNEXT command in Figure 6 takes advantage of the system variable ?DocNumber to assign the current document number to the variable StartDoc. The SwitchDoc command after the loop then switches to the original document as the last step in the macro.

SAVEALL2 also solves another potential problem. While running the macro in Figure 5, it's all too easy to cancel the macro accidentally if you hit the Esc key—as you might in response to the Save dialog box if you don't want to save a particular document to disk. The macro in Figure 6 adds the CANCEL (Off!) command as the second line, telling WordPerfect to ignore the Esc key when that keystroke would cancel the macro. Note that even with the CANCEL (Off!) command in-

```
DISPLAY(On!)
FORNEXT(Docnum; 1; 9; 1)
     SwitchDoc(Docnum)
     IF (?DocBlank)
          Close
     ELSE
       IF (?DocModified)
            Save
       ENDIF
     ENDIF
ENDFOR
```

FIGURE 5: *This WordPerfect for DOS 6.0a macro SAVEALL.WPM will sa e all open documents and close any blank document windows.*

```
DISPLAY(On!)
CANCEL(OFF!)
ASSIGN(StartDoc; ?DocNumber)
FORNEXT(Docnum; 1; 9; 1)
     SwitchDoc(Docnum)
     IF (?DocBlank)
          Close
     ELSE
       IF (?DocModified)
            Save
       ENDIF
     ENDIF
ENDFOR
SwitchDoc(StartDoc)
```

FIGURE 6: *SAVEALL2.WPM is similar to the macro in Figure 5, but it returns you to the document window that you started from when the macro finishes.*

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CIRCLE 101 ON READER SERVICE CARD

cluded, you can still cancel the macro, using Ctrl-Break. Both macros are available in the WordProc/DTP section of the Utilities/Tips Forum on ZiffNet. Look for the file SAVEWP.ZIP.—*M. Da id Stone*

SPREADSHEETS

An Excel Date-Entry Dialog

I' e been trying to create an Excel 5.0 macro that would allow me to change the date in a three-line heading. My attempts to change the date in this heading

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using the InputBox prompt ha e been unsuccessful. Can you show me how to do it?
PETE A. DELA CRUZ, Ewa Beach, Hawaii

PC MAGAZINE: Try the following:

```
Sub GetNewDate()
  NewDate = Application.InputBox  _
  ("Enter a date", _
   "Update the Date", _
   , , , , , 1)
    If NewDate Then
      With Sheets("Sheet1")
        .Range("A3")
        .Value = NewDate
        .NumberFormat = "MMMM, YYYY"
      End With
    End If
End Sub
```

For "Sheet1" and "A3", substitute the actual sheet name and cell location where the third line of your header is to appear.

The InputBox method's first two arguments supply the dialog box's prompt and caption, respectively. The final argument specifies a data type. Using a 1 as this argument's value ensures that the user will supply either a formula or a value. If the user types text, Excel displays an error message and lets the user try again.

The .NumberFormat line assigns a date format in which only the month (spelled out in capital letters) and the year (four digits) appear. With this format, for example, any date value from 4/1/95 to 4/30/95 will cause cell A3 to display APRIL, 1995.

Enclosing the With/End With construction inside an If/End If block allows cell A3 to retain its current value if the user clicks the Cancel button or presses Esc. If you omit this detail, canceling out of the InputBox dialog will cause A3 to display an ugly FALSE. —*Craig Stinson*

DATABASES

Playing Sound Files in FoxPro for Windows

We needed a way to control the proliferation of sound clips used in our Windows applications. Our LAN was getting peppered with .WAV files. To sol e the problem, we created the routine in Figure 7. It lets us ha e one sound library in the Windows directory and standardized clips in e ery application.
JOHN MECH, Frankfort, Illinois

PC MAGAZINE: You can think of the Windows API as a collection of standard functions stored in a number of dynamic link libraries (.DLLs) in your Windows and Windows\System directories. One of those .DLLs is called MMSYSTEM, and it includes standard functions that provide multimedia services under Windows. The SndPlaySound function is one of those residing in the MMSYSTEM.DLL file.

To call the SndPlaySound API function from FoxPro, you must use the FOXTOOLS .FLL library, a FoxPro API library that allows you to call most functions in Windows DLLs. The documentation for Foxtools can usually be found in the GOODIES\FOXTOOLS subdirectory of your FoxPro directory. Look for the FOXTOOLS.WRI file.

You activate the Foxtools library using the SET LIBRARY TO command, like this:

```
SET LIBRARY TO SYS(2004) +
➥"FOXTOOLS.FLL" ADDITIVE
```

The SYS (2004) function returns the directory where FoxPro was started, which is where the Foxtools library normally resides. The ADDITIVE keyword adds Foxtools to the list of currently loaded libraries. If you don't include the ADDITIVE keyword, any existing libraries are unloaded before Foxtools is loaded, making their functions unavailable.

Once the Foxtools library is loaded, you can use the REGFN function to register the Windows API functions you intend to call. You pass the REGFN function the name of the API function, a string describing the types of arguments the API function will accept, a string describing the return type, and the name of the .DLL file where the function resides. For instance, the following call to REGFN registers the SndPlaySound API function:

```
Snd = REGFN("SndPlaySound","CI",
➥"I","MMSYSTEM")
```

The CI encodes the types of parameters passed to the function: C for character and I for integer. The I encodes the return value of the function, in this case integer.

If the call to REGFN is successful, it returns a number that can be used to call the Windows API function. Finally, to call the Windows API function, you use the Foxtools CALLFN function, passing it the number returned by REGFN and any arguments needed by the API function.

For more details on the Foxtools interface to the Windows API, including complete information about REGFN and correctly encoding the parameter types, see the FOXTOOLS.WRI file.

The code in Figure 7 uses this technique to call the SndPlaySound function. I modified Mr. Mech's routine to place the call to the SndPlaySound API function in a separate wrapper function called SndPlaySound. That way you can easily cut and paste the SndPlaySound function shown in Figure 7 into your own programs.

The SndPlaySound API function accepts two parameters. The first defines the sound to play and the second supplies optional flags that affect how the sound is played. In FoxPro for Windows the first parameter can be either the name of a .WAV file or a keyname in the [sounds] section of your WIN.INI file.

For example, if the [sounds] section in your WIN.INI file has a .WAV file assigned to the MouseClick keyname like this:

```
MouseClick=C:\CLICK.WAV, Click
```

you can use MouseClick as the first parameter to SndPlaySound. Or you could specify a .WAV filename such as C:\WINDOWS\CHORD.WAV.

The second parameter accepts some combination of the following values:

```
#DEFINE SND_SYNC  0
#DEFINE SND_ASYNC 1
#DEFINE SND_NODEFAULT 2
#DEFINE SND_LOOP 8
#DEFINE SND_NOSTOP 16
```

The first value, SND_SYNC, is used to play the sound synchronously: Control will not be returned to FoxPro until the sound is finished playing. The second, SND_ASYNC, starts playing the sound and immediately returns control to FoxPro, you'll probably use this most often. SND_SYNC is the default.

If the specified sound doesn't exist, or if it won't fit into available memory, SndPlaySound plays the default sound specified by the SystemDefault entry in the [sounds] section of the WIN.INI file. If there is no default system sound to play, SndPlaySound fails. If you don't want the default system sound to play, specify the SND_NODEFAULT flag. To specify more than one flag, add them together. For example, using the SndPlaySound function in Figure 7:

```
=SndPlaySound("MouseClick",
➥SND_ASYNC + SND_NODEFAULT)
```

asynchronously plays the .WAV file associated with the MouseClick entry in the [sounds] sec-

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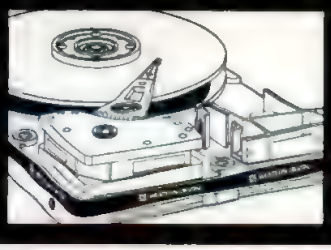

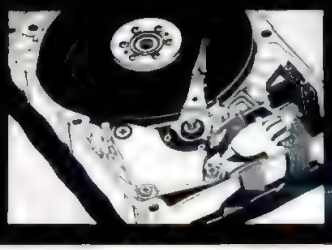

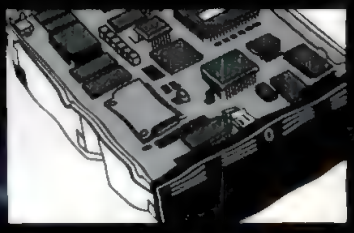

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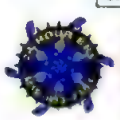

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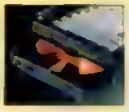

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```
*********************************************************************
* FUNCTION SndPlaySound(cWave, cFlags)          FoxPro for Windows 2.6
* Calls the SndPlaySound Windows API. Pass the name of the sound to
* be played and flags that affect how the sound is played.  For more
* information see the Multimedia Programming Guide in the Windows SDK.
*********************************************************************
* Constants for SndPlaySound API function

#DEFINE SND_SYNC  0            && Wait for sound to finish
#DEFINE SND_ASYNC 1            && Don't wait for sound to finish
#DEFINE SND_NODEFAULT 2        && Don't use default sound
#DEFINE SND_LOOP 8             && Play continuously
#DEFINE SND_NOSTOP 16          && Don't stop current sound

FUNCTION SndPlaySound
PARAMETER cWave, cFlags
SET LIBRARY TO SYS(2004)+"FOXTOOLS.FLL" ADDITIVE
Snd = REGFN("SndPlaySound","CI","I","MMSYSTEM")
nErr = CALLFN(Snd, cWave, cFlags)
RETURN nErr

*********************************************************************
* FUNCTION Fsounds                              FoxPro for Windows 2.6
* Plays the Windows sound passed in the parameter. To save memory and
* process time, the sound file names are hard coded in here instead of
* in a database.  Boolean plSounds must be .T. and made public for
* sounds to occur (plSounds lets user toggle on/off sound effects).
* Sample call: =fsounds("Error")
*********************************************************************
FUNCTION fsounds
PARAMETER lcType
IF !plSounds                   && If plSounds isn't .T., no sounds
   RETURN
ENDIF
IF EMPTY(lcType)
   lcType = "ding"             && Default sound is ding
ENDIF
lnError = .F.
lctype = UPPER(lcType)
*
*  Here are the hardcoded sounds.  All sounds are played
*  asynchronously.  If a sound file is rot found you get a ding.
*
DO CASE
CASE lcType = "ALARM"
   lcId = "wcinact.wav"
CASE lcType = "ERROR"
   lcId = "ding.wav"
CASE lcType = "EXIT"
   lcId = "chimes.wav"
CASE lcType = "EXTRACT"
   lcId = "chord.wav"
CASE lcType = "LOADING"
   lcId = "chord.wav"
CASE lcType = "RUSURE"
   lcId = "chord.wav"
CASE lcType = "STARTUP"
   lcId = "ding.wav"
CASE lcType = "MESSAGES"
   lcId = "wcformes.wav"
OTHERWISE
   lcId = lcType+".wav"
ENDCASE
lnError=SndPlaySound(lcId, SND_ASYNC)
RETURN
```

FIGURE 7: *You can use the SndPlaySound function to play sounds in your FoxPro for Windows programs. Fsounds shows a technique for standardizing sounds within an application.*

tion of your WIN.INI file. No sound is produced if there is no MouseClick entry, if the associated .WAV file does not exist, or if there isn't enough memory to load the .WAV file.

You can use the SND_ASYNC and SND_LOOP flags to play a sound repeatedly. For instance, using the wrapper function shown in Figure 7, the following statement will play the DING.WAV file repeatedly:

```
=SndPlaySound("DING.WAV",
➥SND_ASYNC + SND_LOOP)
```

The looped sound will play repeatedly until another sound is played. If you want to stop the looping sound without playing another sound, use the following call:

```
=SndPlaySound(0,0)
```

You can use the SND_NOSTOP flag to prevent interruption of a sound that is currently playing. If a sound is playing and you call SndPlaySound with the SND_NOSTOP flag, the current sound is not interrupted and the function returns without producing any additional sound.

For more information on SndPlaySound, see the Windows SDK Multimedia Programming Guide either in printed form or on the Microsoft Developer Network Development Library CD (which I highly recommend).

Mr. Mech's fsounds function is an example of how you might code a standard sound-playing function for an application developed by a number of different programmers, possibly on a network. It standardizes the sounds by "type" and supports a mechanism, via the plSounds global variable, for disabling sounds entirely, perhaps temporarily.

You can download the code in Figure 7 from ZiffNet. Look for the SOUND.PRG file in the Spreadsht/DBMS section of the Utilities/Tips Forum.—*Sal Ricciardi*

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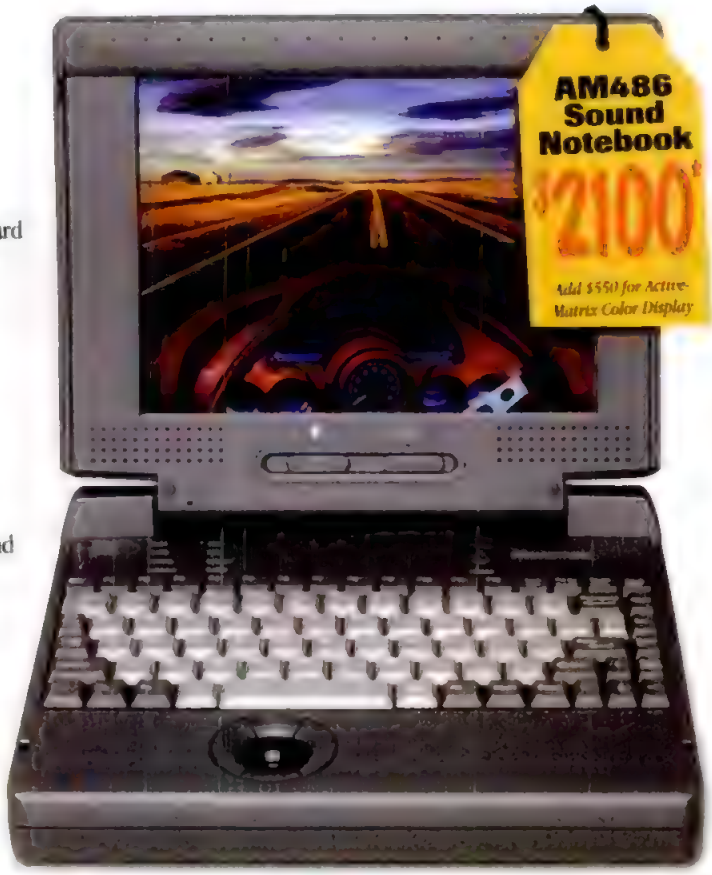

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Pentium® 75MHz	16/540MB	3x3	IBA657635H	2,168
Pentium® 75MHz	16/850MB	3x3	IBA657637H	2,263
Pentium® 75MHz	8/540MB	5x5	IBA658635F	1,890
Pentium® 75MHz	16/540MB	5x5	IBA658635H	2,223
Pentium® 75MHz	16/850MB	5x5	IBA658637H	2,340
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Pentium® 90MHz	16/540MB	3x3	IBA657645H	2,570
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Pentium® 90MHz	8/540MB	5x5	IBA658645F	2,283
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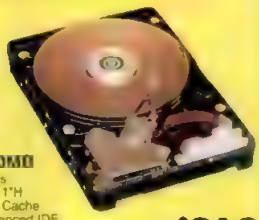

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1060MB	IDE	WD31ØØØA	10ms	3.5" 1"H	299
1280MB	IDE	WD312ØØA	10ms	3.5" 1"H	319
1620MB	IDE	WD316ØØA	9ms	3.5" 1"H	499
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425MB	IDE	CFS425A	14ms	3.5" 1"H	$165
541MB	IDE	CFS54ØA	14ms	3.5" 1"H	189
850MB	IDE	CFS85ØA	14ms	3.5" 1"H	235
1275MB	IDE	CFA1275A	14ms	3.5" 1"H	325
Maxtor					
425MB	IDE	MX7425AV	12ms	3.5" 1"H	$175
540MB	IDE	MX754ØAV	12ms	3.5" 1"H	185
850MB	IDE	MX785ØAV	12ms	3.5" 1"H	235
1260MB	IDE	MX7126ØAV	12ms	3.5" 1"H	335
Quantum					
420MB	IDE	QULT42ØA	12ms	3.5" 1"H	$165
544MB	IDE	QUFB54ØA	11ms	3.5" 1"H	195
850MB	IDE	QULT85ØA	14ms	3.5" 1"H	239
Seagate					
262MB	IDE	ST93ØØAG	16ms	2.5" 12.7mm	$219
341MB	IDE	ST9385AG	16ms	2.5" 19mm	275
524MB	IDE	ST9655AG	16ms	2.5" 19mm	399
545MB	IDE	ST366ØA	14ms	3.5" 1"H	175
854MB	IDE	ST585ØA	11ms	3.5" 75"H	225
1063MB	IDE	ST3122ØA	12ms	3.5" 1"H	279
5180MB	IDE	ST51ØØØA	11ms	3.5" 75"H	CALL

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- Fast SCSI-2

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From the Mass Storage Experts.

Capacity**	Type	Prod. Code	Access	FF/Ht.	Price
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2100MB	SCSI	MC4221AV	8.5ms	3.5" 1"H	$875
2100MB	SCSI	MC4221AVW	8.5ms	3.5" 1"H	975
4300MB	SCSI	MC3243AV	8.5ms	3.5" HH	1,249
4300MB	SCSI	MC3243AVW	8.5ms	3.5" HH	1,349
9100MB	SCSI	MC1991AV	12ms	5.25" FH	2,275
9100MB	SCSI	MC1991AVW	12ms	5.25" FH	2,375
CONNER					
1080MB	SCSI	CFP1ØØØS	11ms	3.5" 1"H	$469
2147MB	SCSI	CFP2105S	8.5ms	3.5" 1"H	879
2147MB	SCSI	CFP2107S	8.5ms	3.5" 1"H	999
4294MB	SCSI	CFP4207S	9ms	3.5" HH	1,259
Quantum					
540MB	SCSI	QUFB54ØS	12ms	3.5" 1"H	$209
850MB	SCSI	QUTR85ØS	14ms	3.5" 1"H	279
1080MB	SCSI	QUFB1Ø8ØS	12ms	3.5" 1"H	379
2216MB	SCSI	QUXP2221S	8.5ms	3.5" 1"H	799
2150MB	SCSI	QUXP3125S	8ms	3.5" 1"H	895
4280MB	SCSI	QUGP428ØS	8.5ms	3.5" HH	1,139
Seagate					
1052MB	SCSI	ST3123ØN	9ms	3.5" 1"H	$495
2147MB	SCSI	ST3243ØN	9ms	3.5" 1"H	839
2147MB	SCSI	ST3255ØW	8ms	3.5" HH	1,005
2145MB	SCSI	ST3255ØN	8ms	3.5" HH	949
4294MB	SCSI	ST1515ØN	8ms	3.5" HH	1,349
4294MB	SCSI	ST1523ØN	8ms	3.5" HH	1,079
4294MB	SCSI	ST1515ØW	8ms	3.5" HH	1,409
9080MB	SCSI	ST41ØØØN	11ms	5.25" FH	2,565

**Capacities based upon manufacturer's quoted capacity where 1MB=1,048,576 bytes

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540	3	512K	600x300	HPDJ54Ø	$229
660C	3	64K	600x300	HPDJ66ØC	479
1600C	8	4MB	600x600	HPDJ16ØØC	1,359
1600CM	8	6MB	600x600	HPDJ16ØØCM	1,989

LaserJet	PPM	MEM	DPI	Prod. Code	Price
4L	4	1MB	300	HPLJ4L	$509
5P	6	2MB	600	HPLJ5P	859
5MP	6	3MB	600	HPLJ5MP	999
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BJ-200EX	248	62K	720	CNBJ2ØØEX	235
BJ-30 Portable	346	35K	720	CNBJ3Ø	259
BJC-70 Col. Port	346	35K	720	CNBJC7Ø	359
BJC-4000	496	64K	720	CNBJC4ØØØ	359
BJ-230	246	41K	360	CNBJ23Ø	399
BJC-600E	240	60K	720	CNBJC6ØØE	469

Laser	PPm	RAM	DPI	Prod. Code	Price
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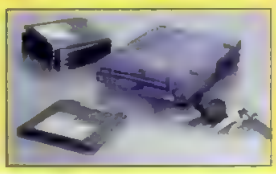

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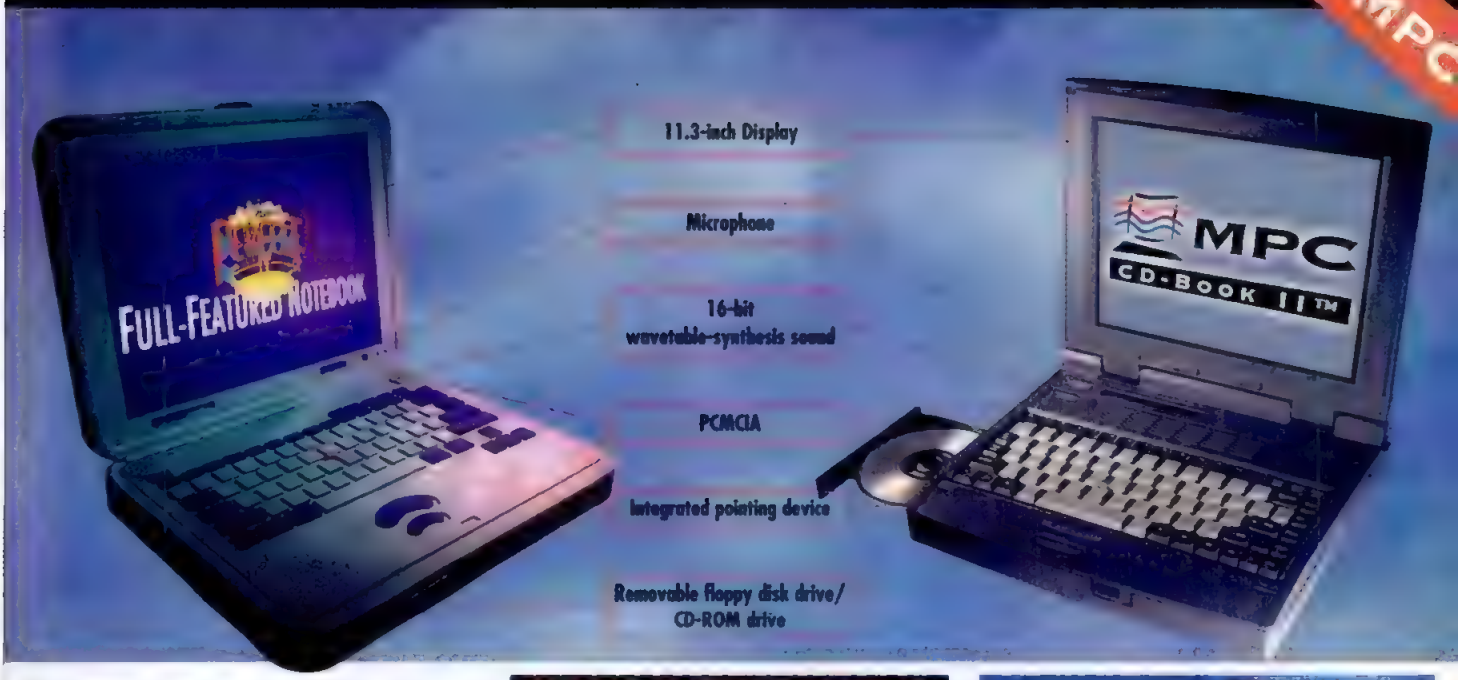
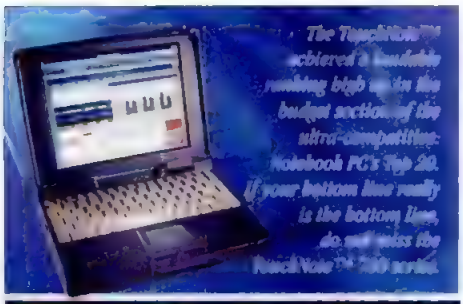


Editors, analysts, and technicians at PC Magazine have spent months searching and testing in order to specify the perfect notebook - the optimal combination of performance, features and price, that suits the needs of most notebook computer users. These professionals compiled a wish list of performances in display, pointing device, battery, hard drive & CD-ROM drive, CPU, memories and accessories. Independently, MPC Technologies has come up with our own unique CD-Book II™, 900 series. Feature for feature, the MPC CD-Book II™ matches closely to what the independent experts deemed to be the perfect choices. The CD-Book II™ is our answer to the editors' wish list. Make CD-Book II™ your perfect notebook today.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[illegible]	-	-	9.00	8.00
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256x4 (Page Zip)	8.25	[illegible]	6.95	6.95	-
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Bravo 486/25, 486/33	2 Meg Kit	500780-005	118.00
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	[illegible]	[illegible]	279.00
	[illegible]	[illegible]	79.00
DeskPro 386/20E	[illegible]	[illegible]	189.00
DeskPro 386/25E	[illegible]	[illegible]	279.00
	[illegible]	[illegible]	79.00
DeskPro 286n, 386n, 386SXO, all "M" series, system LT series, all "T" series	[illegible]	[illegible]	189.00
	[illegible]	[illegible]	189.00
	[illegible]	[illegible]	355.00
	[illegible]	[illegible]	189.00
	[illegible]	[illegible]	189.00
	[illegible]	[illegible]	298.00
	[illegible]	[illegible]	238.00
	[illegible]	[illegible]	437.00
DeskPro 286 } ALL OF THESE MACHINES USE THESE MODULES	[illegible]	[illegible]	49.00
DeskPro 5/60	[illegible]	[illegible]	376.00
Prosignia 5/60	[illegible]	[illegible]	676.00
Prolian 100 5/60	[illegible]	[illegible]	1429.00
Prolian 2000 4/30 5/66	[illegible]	[illegible]	2476.00
Prolian 4000 4/50 5/66	[illegible]	[illegible]	2679.00
Proliant 386 3/25S 3/25ZS	[illegible]	[illegible]	90.00
Proliant 486 4/25S, 4/33 4/50 4/66 CDS	[illegible]	[illegible]	298.00
Enhanced Proliant, Prosignia series	[illegible]	[illegible]	95.00
	[illegible]	[illegible]	169.00
	[illegible]	[illegible]	339.00
Prosignia PC Server 486/33	[illegible]	[illegible]	339.00
486 DX2/66	[illegible]	[illegible]	599.00
	[illegible]	[illegible]	1199.00

COMPAQ LAPTOPS & NOTEBOOKS

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MODEL	AMT UPGRADED	MANU. PART #	PRICE
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NOTEBOOK, LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU. PART #	PRICE
[illegible]	[illegible]	[illegible]	[illegible]

PCMCIA VERSION 2.0
(for Palmtop & Subnotebooks)

MODEL	PRICE	MODEL	PRICE
[illegible]	[illegible]	[illegible]	[illegible]

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LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	OK Bd	256k	1	2	3	3.5	4	5	6	8	16	32
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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NOTEBOOK BATTERIES

Manufacturer	System	Spec	Model	Price
Acer	AcerNote 730c, 735c; AcerNote 760c/cx 780cx	9V 5800mAh, NiMH	B781	139.00
Apple	PowerBook 140 145/B PowerBook 150 160, 165c PowerBook 170 180c PowerBook 520c, 540c PowerBook Duo 210 PowerBook Duo 230, 250 PowerBook Duo 270c, 280c	9V 2800mAh, NiCd	B141	94.00
		9.6V 1900mAh, NiMH	B181	94.00
		12V 1600mAh, NiMH	B182	94.00
AST	Power Exec Advantage! Explorer Bravo NB	14.4V 2400, NiMH	B884	129.00
		9.6V 2400mAh NiMH	B882	119.00
AT&T	SA/A/N NSX/20, 3170	12V 1400MAH, NiCD	B888	69.00
Compaq	LTE Lite 25/25s/C LTE Lite 4/25,6/C, 4/33C	12V 2200mAh NiMH	B298	159.00
	Contura 3/25C Contura 4/25,5/C,C4 Contura Aero 4/25	12V, 2400mAh, NiMH	B291	129.00
		10.8V, 1500mAh, NiMH	B290	79.00
	Contura Aero 4/25C, 4/33/C Contura 400C/CX, 410C/CX	10.8V 2400mAh, NiMH	B291	119.00
Epson	ActionNote 4000 ActionNote 4SLC2-50 ActionNote 500 ActionNote 500C ActionNote 850/C ActionNote 750/C/CX ActionNote 860/CX	9.6V, 1700mAh, NiCd	B888	79.00
		9.6V 1700mAh, NiCd	B883	79.00
		9.6V 2400mAh, NiMH	B886	129.00
		12V, 2800mAh NiMH	B882	NB.00
		9.6v, 2200mAh, NiMH	B888	Call
		12v, 1800mAh, NiMH	B886	Call
IBM	PS/2 Note L,486SX ThinkPad 300 ThinkPad 350/C ThinkPad 360/Cs/C/P ThinkPad 700/C 730/C ThinkPad 750/Cs/C/P ThinkPad 750Cs/C	10.8V 2400mAh, NiCd	B379	79.00
		12V, 2500mAh NiMH	B388	169.00
		9.6V 2900mAh NiMH	B389	179.00
		10.8V, 3000mAh, NiMH	B378	129.00
		9.6V 3300mAh, NiMH	B387	209.00
NEC	UltraLite SL/2040 SL/25C Versa E Versa V Versa 5	12V 1700mAh NiCd	B070	69.00
		7.2V 3700mAh NiMH	B089	129.00
		12v 1800mAh NiMH	B083	Call
Packard Bell	PB2/Bell PB386NBX Stylus/Ivan	4.8V 5000mAh, NiCd	B575	54.00
		14.4V 1700mAh, NiCd	B885	129.00
Sharp	PC 7700 PC-7750 PC-8150 PC-8650/II, PC-8600 PC-8700 PC 8800	14.4V 2300mAh, NiMH	B885	139.00
		14.4V 1800mAh, NiMH	B887	169.00
TI	TravelMate 3000 TravelMate 4000/E TravelMate 4000M	4.8V 5000mAh NiCd	B847	59.95
		12V 2500mAh, NiMH	B889	129.00
Toshiba	T1000SE XE LE T1200XE T1200 T2000SX/SXS T2000SX T3300SL T4400SX/SXC/C T4500/C T4600/C T1850/C/CT T1950CS/CT T2105/CS/CT/T T2105/CS/CT T2150CDS T2400CS/CT T2450CT T4700CS/CT T4800CT T4900CT	7.2V 1800mAh NiCd	B437	Call
		7.2V 2200mAh NiCd	B488	59.00
			B489	159.00
		14.4V 2400mAh NiMH	B488	NB.00
		10.8V 2400mAh, NiCd	B482	319.00
		9.6V 3000mAh, NiMH	B487	169.00
		9.6V 2800mAh, NiCd	B481	79.00
		12V 2600mAh NiMH	B488	129.00
		12v, 2600mAh, NiMH	B486	Call
Zenith	Z-Note Series	12V 2500mAh, NiMH	B685	149.00

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Manufacturer	System	Model	Price
Apple	PowerBook 140, 145, 145B PowerBook 150, 160, 165c PowerBook 170, 180, 180c	C106	159.00
Compaq	Contura Aero 4/25, 4/25C Contura Aero 4/33 4/33C Contura 400C, 400CX, 410C, 410CX	C203	159.00
Epson	ActionNote 4SLC2-80 ActionNote 4SLC/33, 500 ActionNote 560C, 880CX	C806	159.00
IBM	ThinkPad 350 350C ThinkPad 360, 360Cs, 360C, 360P ThinkPad 750/Cs/C/P 750 Cs/C	C304	159.00
NEC	UltraLite Versa E Versa V	C001	159.00
Sharp	PC-8700 PC-8800	C002	159.00
TI	TravelMate 3000, 4000, 4000E TravelMate 4000M	C807	159.00
		C812	159.00
Toshiba	T1000, T1000C T1910 T1910CS T1850 T1850CS/CT T1950CS/CT T2400CS/CT T2450CT T4700CS/CT T4800CT T4900CT T4500 T4800	C402	
		C40	199.00

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Manufacturer	System	Model	Price
Acer	AcerNote 730c, 735c, 760c/cx, 780/cx AcerNote 750	M702	69.00
		M705	69.00
Apple	PowerBook 140 145/B, 150 PowerBook 160, 165c, 170, 180c PowerBook 520c, 540c PowerBook Duo 210 230, 250 PowerBook Duo 270c, 280c	M109	69.00
		M108	69.00
		M101	69.00
AST	Advantage! Explorer Bravo NB	M807	69.00
Compaq	Contura 3/25C, 4/25C 4/33/C Concerto Contura Aero 4/25/C, 4/33/C Contura 4/33/C Contura 400C/CX, 410C/CX LTE Lite LTE Lite/25/25c/25E LTE Lite 4/25/25E, 4/33C	M701	69.00
		M702	69.00
		M705	69.00
		M705	69.00
		M292	69.00
		M293	69.00
		M204	69.00
Dell	Latitude 433C	M807	69.00
Epson	ActionNote 4SLC2-50, 4SLC/33, 960C ActionNote 886C 880CX	M808	69.00
IBM	ThinkPad 350/c, 360/Cs/C/P ThinkPad 700/C 720/C, 750/Cs/C/P, 750Cs/C ThinkPad 500	M801	69.00
		M806	69.00
NEC	Versa 5	M001	69.00
Sharp	PC-8150 PC-8650, PC-8600 II, PC-8800 PC-8700 PC-8800	M002	69.00
		M004	69.00
TI	TravelMate 4000/E TravelMate 4000M	M801	69.00
		M803	69.00
Toshiba	T1000, T1850/C T4800/C T4600/C	M803	69.00

MICROBOLT DC AUTO ADAPTER (Cont'd)

Manufacturer	System	Model	Price
	T200 DynaPad T3400 Portege, T3000 Portege T1000/C, T1910/CS T1850/CS/CT T1950/CS/CT T2400/CS/CT T2450/CT T4700CS/CT T4800CT T4900CT	M401	69.00

DELL

Model No.	Capacity	OEM Part No.	Price
Dimension 425S/V 433S/V 466V	4MB	310-3325	155.00
Dimension 325 450V 466V 466V 466V	16MB	310-3327	539.00
Dimension XPS P60, P90, P100	4MB**	310-3325	155.00
	8MB**	********	310.00
	16MB**	310-3327	539.00
	32MB**	********	1118.00
Low Profile Power Desktop 466P/16, 20, 25, 33, 50, 66	1MB	310-2505	59.00
Power Desktop 466D/16, 20, 25, 33, 50, 66	4MB	310-2507	169.00
	16MB	310-2625	619.00
OptiPlex 425nL(V), 433nL(V), 450nL(V), 466nL(V) OptiPlex 425xM(V), 433SxM(V), 450xM(V), 466xM(V) Performance 425nL, 433nL, 433sL, 450nL, 466nL Performance 425xM, 433xM, 433sM, 450xM, 466xM Performance 425xME 433xME 433sME 450xME 466xME	4MB	310-3325	155.00
Performance 433/7 450/7 466/7	16MB	310-3327	539.00
OmniPlex 433ME, 450xME, 466xME, 4100xME	4MB**	310-3325	155.00
OptiPlex 560L, 10, 575, 33, 590, XMT 590	8MB**	********	310.00
PowerEdge XE 433, 433s, 450, 466	16MB**	310-3327	539.00
	32MB**	********	1118.00
OmniPlex 590/ME, 590/ME, 590/ME, 5100/ME	8MB (std)**	310-3335	338.00
PowerEdge SP 433, 450, 466	16MB (std)**	********	710.00
PowerEdge SP 560, 566, 580, 5100	32MB (std)**	310-3337	1236.00
PowerEdge XE 560, 566, 580, 5100	64MB (std)**	********	2566.00
4000/XE Series 486/33 486/50, 486/66	2MB (std)	310-2499	118.00
PowerLine Servers 425SE 425SE 433SE	4MB (std)	310-3487	169.00
PowerLine Servers 450SE 450SE/7 466SE	8MB (std)	310-3488	338.00
PowerLine Workstations 420DE 425DE 433DE	16MB (std)	310-3489	710.00
PowerLine Workstations 450DE 466DE/2, 466DE	32MB (std)	310-2630	1236.00
System 325D 325P 333D 333P	1MB	310-2505	59.00
System 433P	4MB	310-2507	169.00
System 325M & 325MC Notebooks	2MB	310-3210	118.00
System 485TE, 433TE	2MB (std)	310-2499	99.00
	8MB (std)	310-3487	179.00
	8MB (std)	310-2498	269.00
	16MB (std)	310-2499	639.00
System 5L,5D, 25 Notebook	2MB	310-3213	109.00
System 4sx/V 4sex/V 4sx/DV 4sex/DV	4MB	310-3325	155.00
	16MB	310-3327	535.00

** Install memory modules in pairs

DIGITAL EQUIPMENT CORPORATION

Model No.	Capacity	OEM Part No.	Price
AlphaStation 200 4/166	8MB (std)**	FR-PC77M-AA	338.00
AlphaStation 200 4/233	16MB (std)**	FR-PC77M-AB	710.00
AlphaStation 400 4/233	32MB (std)**	FR-PC77M-AC	1236.00
	64MB (std)**	FR-PC77M-AD	2566.00
Celebris 466, 4100, 560, 590	4MB	FR-PC74M-AA	169.00
Celebris **590	8MB (std)**	FR-PC77M-AA	338.00
	16MB	FR-PC74M-AB	619.00
	16MB (std)**	FR-PC77M-AB	710.00
	32MB (std)**	FR-PC77M-AC	1236.00
	64MB (std)**	FR-PC77M-AD	2566.00
DECpc AXP 150	16MB (std)	FR-PC77M-AB	710.00
	64MB	FR2MA-BD	3094.00
DECpc LPx 433sx, 433dx, 450x2, 466x2 DECpc LPx+ 433sx, 433dx, 450x2, 466x2, 466x2, 4100 DECpc LPv 425sx, 433dx, 433sx, 450x2, 466x2 DECpc RDx+ 425sx, 433sx 433dx DECpc LVx+ 450x2 450x2 466x2, 4100	4MB	FR-PC74M-AA	169.00
DECpc MT 433dx, 450x2 466x2	16MB	FR-PC74M-AB	619.00
DECpc MTE 433dx, 466x2, 4100	4MB	FR-PC74M-AA	169.00
	16MB	FR-PC74M-AB	619.00
	32MB	********	1280.00
	64MB (std)	FR-PC77M-AA	2566.00
DECpc 425SX, 433SX 466SX, 450SX 466SX 966SX	4MB	PC1MM-CC	169.00
	8MB	PC1MM-CD	355.00
	16MB	PC1MM-CE	619.00
	32MB	PC1MM-CF	1280.00
DECpc LPs 560, 566	8MB (std)**	FR-PC77M-AA	338.00
DECpc XL 434dx, 466x2, 4100, 560, 566, 590	16MB (std)**	FR-PC77M-AB	710.00
DECpc XL Server 466, 4100 560 566 590	32MB (std)**	FR-PC77M-AC	1236.00
	64MB (std)**	FR-PC77M-AD	2566.00
DEC 2000 ALPHA AXP 300	16MB (std)	PB2MA-BD	710.00
	64MB (std)	PB2MA-BF	2566.00
	128MB (std)	********	5186.00
Hillsite CS433, CS466, CT450, CT470 notebook	4MB	FR-PC27M-AA	169.00
Hillsite Monochrome 433 notebook	8MB	FR-PC27M-AB	379.00
	16MB	FR-PC27M-AC	649.00
VAXstation 4000 VLC	8MB (std)	MS40-BA	736.00
Venturis 33mhz 433sx, 450x2, 466, 4100, 560	4MB	FR-PCVMM-AA	155.00
Venture Slimline Multimedia 466	8MB	FR-PCVMM-AB	309.00
Venture* Full Profile 450x2, 466, 4100	16MB	FR-PCVMM-AC	539.00
Venture* Multimedia 466	32MB	FR-PCVMM-AD	1149.00

** Install memory modules in pairs

EPSON

Model No.	Capacity	OEM Part No.	Price
Endeavor 463X/25C, 463X/33C, 463X/50C	2MB	A808581	69.00
Endeavor WG 424/33 463X/33 463X/50, 463X/66	4MB	A808601	169.00
	16MB	A808051	619.00
Endeavor 466, 466SX/25, 466SX/33	1MB	********	59.00
Endeavor 466, 466DX/33, 466DX2/50, 466DX3/66	4MB	********	169.00
	16MB	********	539.00
Endeavor V, 466SX/25, 466SX/33	4MB**	********	155.00
Endeavor V, 466DX/33, 466DX2/50, 466DX3/66	16MB	********	539.00
Endeavor P60	4MB**	********	155.00
	8MB**	********	309.00
	16MB**	********	619.00

** Install memory modules in pairs

NEC

Model No.	Capacity	OEM Part No.	Price
Express RISCserver	4MB	OP-410-30001	169.00
RISCserver 2200	8MB	OP-410-30002	355.00
RISCstation 2000	16MB	OP-410-30003	619.00
	32MB	OP-410-30004	1189.00

** Install memory modules in pairs

Image 425, 433, 466

	4MB	OP-410-12002	169.00
	16MB	OP-410-12003	619.00
Image 450, 466, 466xe, 4100xe	4MB	OP-410-30001	169.00
Image 450H, 466H, 4100H	8MB	OP-410-30002	355.00

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NEC (Continued)

Model No.	Capacity	OEM Part No.	Price
	16MB	OP-410-30003	619.00
	32MB	OP-410-30004	1299.00
Image P60, P90, P66, P100E			
Image RISCstation	4MB	OP-410-30001	169.00
PowerMate P600 P800	8MB	OP-410-30002	355.00
Ready P60M	16MB	OP-410-30003	619.00
	32MB	OP-410-30004	1299.00
PowerMate 386/33	1MB	OP-410-6204	59.00
	4MB	OP-410-6205	169.00
	16MB	OP-410-6206	619.00
PowerMate 425sx, 433sx, 450sx, 466sx	4MB	OP-410-30001	169.00
Ready 425sx, 433sx, 466sx	16MB	OP-410-30003	619.00
PowerMate 433D 466D 466M 4100M	4MB	OP-410-14003	155.00
Ready 433D, 466D, 466M, 4100M	8MB	OP-410-14004	309.00
	16MB	OP-410-14005	539.00
	32MB	OP-410-14006	1149.00
PowerMate Express 486SX/20s, 486SX/25s, 486/50s	1MB	OP-410-6204	59.00
	4MB	OP-410-6205	169.00
PowerMate Express 486/33s, 486DX2/66E			
PowerMate Express 486SX/25T4, 486/33T4	1MB	OP-410-6204	59.00
PowerMate Express 486/50T4 486/66T4	4MB	OP-410-6205	169.00
	16MB	OP-410-6206	619.00
PowerMate Express/II 433ST, 466ST	4MB	OP-410-30001	169.00
	16MB	OP-410-30003	619.00
	32MB	OP-410-30004	1299.00
PowerMate Express/II 4100ST	4MB	OP-410-30001	169.00
PowerMate Express/II P60LT P60LT P90LT	8MB	OP-410-30002	355.00
PowerMate Express/II P80ST, P88ST	16MB	OP-410-30003	619.00
	32MB	OP-410-30004	1299.00

** Install memory modules in pairs

HEWLETT PACKARD

Model No.	Capacity	OEM Part No.	Price
NetServer LE 486SX/33, 486DX/33, 486DX2/66	4MB	D2156A	169.00
	8MB	D2152A	355.00
	16MB	D2576A, D2297A	639.00
	32MB	D2298A	1299.00
NetServer 4/66LE 4/100LC 5/66LC			
NetServer 4/66LF 5/66LF			
NetServer 4/66LI 5/66LI			
NetServer 4/33 LM 4s/66 LM	4MB**	D2974A	169.00
NetServer 5/60 LM, 5/66 LM	8MB**	D2975A	355.00
NetServer 5/66 LM2, 5/90 LM, 5/100 LM	16MB**	D2297A	619.00
	32MB**	D2298A	1299.00
Vectra 386/25 PC			
Vectra 486/33ST 486/66ST			
Vectra 486/25U PC 486/33U PC	2MB**	D2381A	94.00
Vectra 486/50U PC 486/66U PC	8MB**	D2152A	369.00
Vectra 486 PC, 486e/20	1MB**	D2156A	58.00
Vectra 486/25T 486/33T PC	2MB**	D2381A	94.00
	4MB**	D2156A	172.00
	8MB**	D2152A	369.00
Vectra 486/25M PC, 486e/33M PC, 486/33M PC			
Vectra 486/25MP PC 486e/33MP PC 486/50MP PC			
Vectra 486/25N PC 486/33N PC 486/50N PC, 486/66N PC	2MB	D2381A	94.00
Vectra 486/33N, PC 486e/33N PC	4MB	D2156A	169.00
Vectra 486e/33NM PC 486/33NM PC	8MB	D2152A	355.00
Vectra 486/50NM PC 486/66NM PC	16MB	D2576A, D2297A	619.00
Vectra M2 4/25, 4/25s 4/33s 4/33n 4/50 4/50i, 4/66	4MB	D2974A	169.00
Vectra M2 4/33n, 4/33s, 4/50, 4/50i 4/66, 4/100	8MB	D2975A	355.00
Vectra VL2 4/25s 4/33s 4/33n 4/4p 4/66, 4/100	16MB	D2297A	619.00
Vectra XM2 4/50, 4/50, 4/66, 4/66, 4/100, 4/100i	32MB	D2298A	1299.00
Vectra 486/25VL, 486/33VL, 486/66VL	4MB	D2156A	169.00
	8MB	D2152A	355.00
Vectra VL3 5/60	16MB	D2576A, D2297A	619.00
Vectra XP60	4MB**	D2974A	169.00
Vectra XU 5/60 PC, 5/90C PC	8MB**	D2975A	355.00
Vectra XU 5/90 PC, 5/90C PC	16MB**	D2297A	639.00
	32MB**	D2298A	1299.00

** Install memory modules in pairs

ACER

Model No.	Capacity	OEM Part No.	Price
AcerNotes 4000 series	1MB	72.25436.158	
	2MB	72.51236.158	
	4MB	72.80136.008/91.00029.800	
	8MB	72.80236.008/91.00029.802	
	16MB	72.80436.008/91.00029.804	
AcerNotes 6000 series	1MB	72.25436.158	
	2MB	72.51236.158	
	4MB	91.40429.901	
	8MB	91.00029.903	
	16MB	91.00029.904	
	32MB	n/a	
AcerPower 4000 series	4MB	72.80136.008	
AcerPower 9000 series, 9500T series**	8MB	72.80236.008	
AcerPower Pentium series**	16MB	72.80436.008	
	32MB	n/a	

** AcerPower 9500T and Pentium series, install memory modules in pairs

SUN

Model No.	Capacity	OEM Part No.	Price
SPARCstation 1 (SUN 4/60), 1+ (SUN 4/65), IPC (SUN 4/40)	4MB (std)	X104C	179.00
SUN 3/60, 3/80, 4/110	16MB (std)	X1191	679.00
SPARCstation 2 (SUN 4/75)	16MB (std)	X1191	679.00
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SPARCserver 20	16MB	X1180	739
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SPARCserver 330	8MB (std)	X1081	357.00
SPARCstation 330, 370, 390	32MB (std)	X1349	1352.00
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SPARCserver 1000	32/128MB (std)	X1489A	1799/5000
SPARCcenter 2000	64/256MB (std)	X1739A	3416/10,057
SPARCstation Classic LC (SUN 4/15), LX (SUN 4/30)	8MB (std)	X1108A	358.00
	32MB	X1329	1220.00
SPARCstation ELC (SUN 4/25)	4MB	X104G	189.00
SPARCstation IPX (SUN 4/50)	16MB	X1140	819.00
SPARCstation SLC (SUN 4/20)	4MB	X1052	179.00

** Install memory modules in pairs only

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Model No.	Capacity	OEM Part No.	Price
Z-Select 100 Z-425S, Z-433D, Z-433S, Z-460X, Z-466X	4MB	AME 70-UG	155.00
	16MB	AME 120	539.00
	32MB	AME 160	1149.00
Z-Select 160XE 433SX, 466SX/2 466DX/2, 4100DX/4	4MB	AME 70	155.00
	8MB	AME 73	309.00
	16MB	AME 71 AME-120	539.00
	32MB	AME 72 AME-160	1149.00
Z-Select PT	8MB (std)**	AME-410	338.00
	16MB (std)**	AME-420	710.00
	32MB (std)**	AME-430	1236.00
	64MB (std)**	AME-440	2566.00
Z-Server 425SE 433DE, 454DE	4MB (std)**	ME-432	179.00
	8MB (std)**	ME-102	339.00
	16MB (std)**	ME-442	710.00
Z-Server EX 433DE, 466DE, P863	32MB (std)**	ME-82	1236.00
Z-Server LT 433DE, 466DE P80E	4MB (std)**	ME-432	179.00
	8MB (std)**	ME-102	339.00
	16MB (std)**	ME-442	710.00
	32MB (std)**	ME-82	1236.00
	64MB (std)**	********	2566.00
Z-Station 420SEn, 420DEn, 426Sn, 426Dn	1MB	ME-70	59.00
Z-Station 433DEn 433Dn, 450DEn	4MB	ME-100	179.00
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Z-Station EX	8MB (std)**	AME-410	338.00
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Z-Station 500	4MB (std)**	AME-400	179.00
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Z-Station 510	4MB	AME-70	155.00
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Pantera 486SX-33, 486DX-33, 486DX2-66, 486DX4-100	4MB	RAM-0004	159.00
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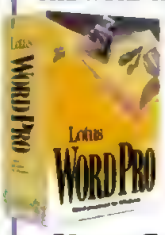

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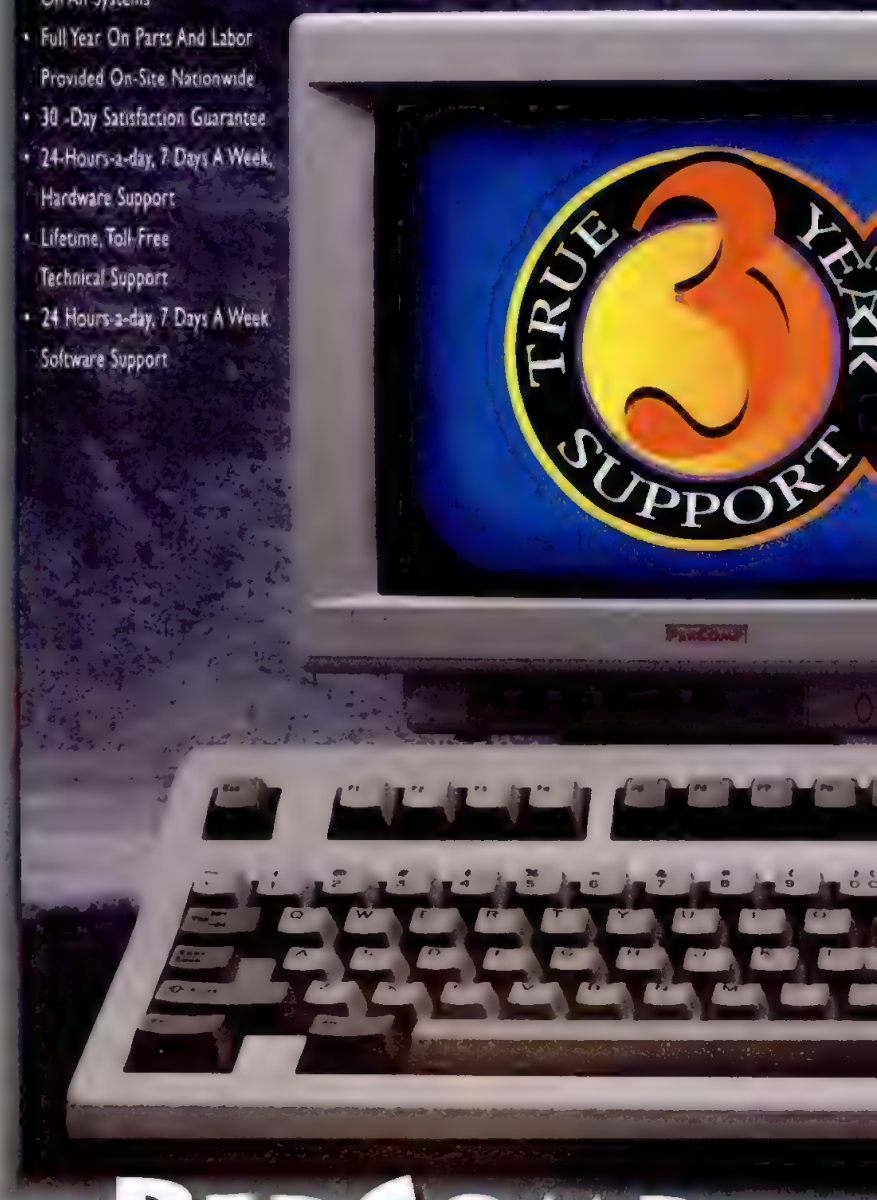

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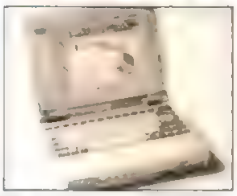

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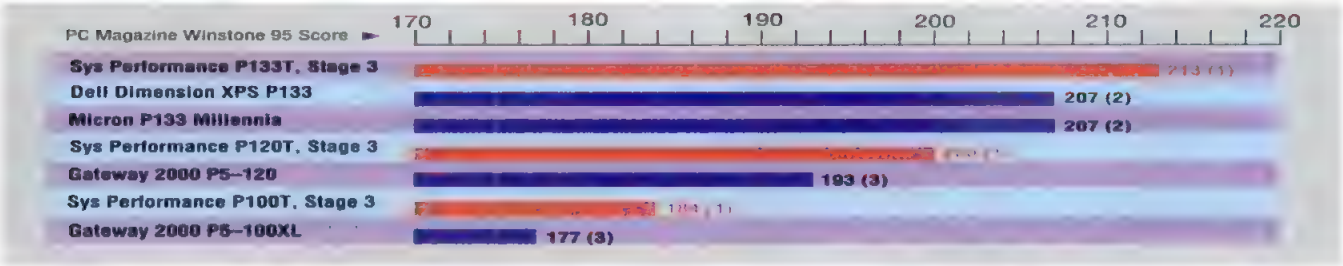

(1) Based on in-house testing; an average of three passes. (2) PC Magazine article, July, 1995. (3) PC Magazine article, May 30, 1995.

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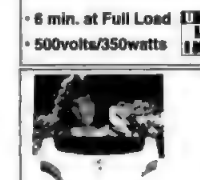

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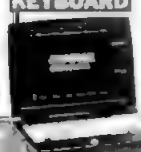

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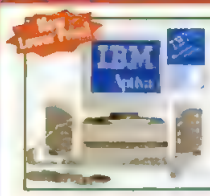

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- HL-655W/HL-660 ..... $579/$629
- HL-960/HL1260 ..... $999/$1219

Multimedia Kits / CD ROM Drives / Speakers

NEC
- MultiSpin 2Xc $459
- MultiSpin 3Xp Plus $379
- MultiSpin 6Xi $454
- MultiSpin 6Xa $544

CREATIVE LABS
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- Discovery CD New Edition $259
- Discovery CD 4X $369
- Digital Schoolhouse 4X $299
- Multimedia Home 4X $449
- Sound Blaster Value Edition $49
- Sound Blaster Pro Value Edition $69
- SoundBlaster Value IDE $99
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- Sound Blaster Value CD $185
- Sound Blaster AWE32 ..... $299
- SoundBlaster Performance 4X $429
- Advanced Signal Proc Upgrade Kit $55
- Wave Blaster II $145
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- Multimedia Kit 4000 ..... $335
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- Multimedia Kit 6000 ..... $385

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- PC Presentions $279

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- LK-MC6045 4X CD-ROM $399

SONY
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- SRS-D22PC $159
- CSD 760E (Quad Speed) $289
- CSD 760S (Quad SCSI) $725

TEAC
- CD-55A (Quad Speed) $219

PLEXTOR
- PX-63CX 6X CD-ROM $489

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- HP ScanJet 3C Scanner (Color) $939
- HP ScanJet 3P Scanner (Mono) $315

CANON
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- IX 3010 Grayscale $299

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- ES300GS $499

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- Satellite T2150CDT 520MB $3627
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- Satellite Pro 400CDT Pentium 75, Active Color, 810MB$4684
- Portage 610CT, Pentium 90, 720MB $4267
- 3490DCT, Pentium 75, 810MB $4474

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- 600C DX2-50 Dual Scan 170MB $2364
- 600C DX2 75 Dual Scan 170MB $2797
- 4000C DX2/50 Dual Scan 340MB $2494
- 4000C DX4-100 Dual Scan 340MB $2937
- 4000CT DX4-100 Act. Clr. 340MB $3347

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- TM4000 M DX4/75, 10.5"Dual Scan 455MB $2427
- TM4000 M DX4/75, 9.5" Active Color 455MB $2799
- TM4000 M DX4/75, 10.5" Active Color 524MB $2757
- TM4000 M DX4/100, 10.5" Active Color 524MB $3427
- TI5000 Pentium 75, 10.5" Dual Scan 524 MB $3074
- TI5000 Pentium 75, 10.5" Active Color 810 MB $4517

COMPAQ
- LTE Elite 4/75C Dual Scan 340MB/510MB ..... $3674/$3847
- LTE Elite 4/75CX Active 340MB/510MB ..... $3927/$4297
- LTE Elite 4/75CXL Active 510MB/810MB ..... $4857/$4927

NEC
- VERSA V/560 250MB Dual Scan $2804
- VERSA V/50C 250MB Active $2724
- VERSA M/750 250MB Dual Scan $2297
- VERSA M/75C 340MB Active $2687
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- 701CS DX4-75 Dual Scan 360MB/540MB ..... $3549/$3849
- 701C DX2 50 Act. Color 360MB/540MB ..... $3699/$4049
- 701C DX4-75 Act. Color 360MB/540MB ..... $4299/$4599
- 755C DX4-75 Color Active 170MB $2999
- 340/540MB ..... $3369/$3699
- 755CSE Color Active 340MB $3499
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- 755CE Color Active 340MB $4299
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—PC MAGAZINE
December 1994

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		Int.	Ext.
NEC	2V SCSI 320ms access 300Kb/sec transfer	n/a	245
CHINON	CDA525 Dual Speed SCSI 280ms access 300Kb/sec transfer	165	225
SONY	CDU-55s Dual Speed SCSI 220ms access 300Kb/sec transfer	195	255
SONY	CDU-55e Dual Speed IDE 220ms access 300Kb/sec transfer	145	n/a
NEC	3Xp+ SCSI 240ms access 500Kb/sec transfer	n/a	375
TEAC	CD-55 QuadSpeed IDE 195ms access 600Kb/sec transfer	195	n/a
NEC	4Xe SCSI 220ms access 600Kb/sec transfer	n/a	449
Plextor	4Plex SCSI 215ms access 600Kb/sec transfer 256K	335	435
TOSHIBA	QuadSpeed SCSI 120ms access 600Kb/sec transfer	355	415
Plextor	6Plex SCSI 145ms access 900Kb/sec transfer	535	635

SCSI Adapters

adaptec

1522A	95
1522K	145
1542CF	285
2742A	365
2842K	280
2742W	425
1640K	395
2940K	315

Mylex

ABP742K	195
ABP752K	255
ABP842K	315
ABP852K	300
ABP542K	185
ABP940K	195
ABP920K	95

UltraStor

ULTRA14F	155
ULTRA24F	255
ULTRA34F	335

DTC

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2290	139
3270VL	115
3280AS	225
3290AS	335

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Modems

US Robotics / Hayes

Sportster int/ext 14.4bps Data/Fax with OL II	95/110
Sportster int/ext V.34 28.8bps with fax	224/242
Sportster int 14.4bps Data/Fax	175
Sportster int V.34 28.8bps Data/Fax	335
Courier int/ext V.34 28.8bps with fax	375/445
Courier int V.34 PCMCIA 14.4bps	375
Courier int V.34 PCMCIA 28.8bps	435
ACCURA14.4 Int/Ext 14.4bps Data/Fax	88/108
ACCURA 28.8 Int/Ext 28.8bps Data/Fax Async	168 /208
OPTIMA14.4 Pocket/Ext 14.4bps Data/Fax	278 /340
OPTIMA28.8 Int/Ext 28.8bps Data/Fax Async	338 /388
Practical Peripherals PM14400HCIIV32 Int/Ext 14.4bps Data/Fax Async	88/98
PM28BHCIIV34 Int/Ext 28.8bps Data/Fax Async	178/209

Optical Drives

FUJITSU / HEWLETT PACKARD / MaxOptics

Capacity	Model	Access	Int.	Ext.
230 MB SCSI	M2511	30ms	525	585
230 MB PC	DynaMo*	30ms	n/a	675
*Includes Adaptec SCSI board adapter kit				
230 MB	DynaMo	30ms	n/a	725
1.3 GB SCSI	HP1716T	23.5ms	2235	2295
1.3 GB SCSI	Tahoe II	18ms	2335	2395

1 free cartridge with each optical drive purchased!

Scanners

Nikon	Scantouch	1299
	Transparency Adapter	599
	Coolscan 35mm film scanner	1399
UMAX	UC630/1260	675/1240
	Vista-S6	760
	Powerlook	3250

SCSI Hard Drive Cabinets

Deskcab™ 3.5" half height open/closed bezel HD enclosure	$75
Minicab™ 3.5" half height open/closed bezel HD enclosure	$69
Full Height Cab 5.25" full height cab	$139
Multi Bay Cabinets 5.25" and 3.5" cabinets available	$CALL

Two, four, six, and eight bay cabinets available. All cabinets come with a 25-50 pin Mac system cable and a power cable. 1 year warranty on all cabinets.

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SCSI & IDE Hard Drives

Seagate

Model	Capacity	Interface	Seek	RPM	Cache	Int.
Hawk 2LP	1.2 GB	SCSI	9.5ms	5400	512K	$495
Hawk 4	4.2 GB	SCSI	9ms	5400	512K	1260
Barracuda	2.4 GB	SCSI	8ms	7200	1024K	970
Barracuda	4.2 GB	SCSI	8ms	7200	1024K	1429
Barracuda Wide	2.4 GB	SCSI	8ms	7200	1024K	1115
Barracuda Wide	4.2 GB	SCSI	8ms	7200	1024K	1545
Elite	9.0 GB	SCSI	11ms	5400	512K	2450
ST3491A	420 MB	IDE	14ms	3800	120KB	160
ST3660A	540 MB	IDE	14ms	3800	120KB	170
ST3850A	850 MB	IDE	12ms	4500	120KB	230
ST31220A	1.2 GB	IDE	12ms	4500	120KB	295

External SCSI units add $60 comes complete with cables!

SPECIALS

Quantum365MB SCSI 11ms seek, 4500 RPM	$145.00
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Seagate 1GB IDE 12ms seek, 4500 RPM	$295.00
Conner 1.06GB SCSI 10ms seek, 5400 RPM	$415.00
Amquest 28.8bps internal V.34 fax/modem	$175.00
TEAC Quad Speed CD Rom IDE 195ms access	$195.00

CONNER

Model	Capacity	Interface	Seek	RPM	Cache	Int.
CFP1060	1.06 GB	SCSI	10ms	5400	256K	415
CFP2105	2.0 GB	SCSI	8.5ms	5400	512K	850
CFP2107	2.1 GB	SCSI	8.5ms	5400	512K	970
CFP4207	4.2 GB	SCSI	8.5ms	5400	512K	1199
CFS425	425 MB	IDE	14ms	3400	64KB	155
CFS540	540 MB	IDE	14ms	3600	64KB	175
CFS850	850 MB	IDE	14ms	3600	64KB	235
CFS1275	1.2 GB	IDE	14ms	3600	64KB	350

External SCSI units add $60 comes complete with cables!

Quantum

Model	Capacity	Interface	Seek	RPM	Cache	Int.
Trailblazer	420 MB	IDE/SCSI	11 ms	4500	128K	155/175
Fireball*	540 MB	IDE/SCSI	10 ms	5400	128K	190/195
Lightning	730 MB	IDE/SCSI	11 ms	4500	128K	215/245
Trailblazer	850 MB	IDE/SCSI	11 ms	4500	128K	235/270
Fireball*	1080 MB	IDE/SCSI	10 ms	5400	128K	365/395
Atlas	2.1 GB	SCSI	8 ms	7200	1024K	890
Grand Prix	4200 MB	SCSI	8.6 ms	7200	512K	1175
Atlas	4.3 GB	SCSI	8 ms	7200	2048K	1495

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- *Always call for the most competitive prices on all hard drives!!!*

WESTERN DIGITAL

Model	Capacity	Interface	Seek	RPM	Cache	Int.
WD2540A	540 MB	IDE	11ms	4500	64KB	195
WD2850A	850 MB	IDE	10ms	4500	64KB	230
WD31200	1.2 GB	IDE	10ms	4500	64KB	340
WD3160	1.6 GB	IDE	10ms	4500	64KB	595

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MICROPOLIS

Model	Capacity	Interface	Seek	RPM	Cache	Int.
M4221	2.1 GB	SCSI	8.5 ms	7200	512K	895
M1936	3.6 GB	SCSI	11 ms	5400	512K	1225
M3243	4.3 GB	SCSI	8.5 ms	7200	512K	1315
M1991	9.0 GB	SCSI	11 ms	5400	512K	2150
M4221Wide	2.1 GB	SCSI	8.5 ms	7200	512K	1035
M3243Wide	4.3 GB	SCSI	8.5 ms	7200	512K	1445
M1991Wide	9.0 GB	SCSI	11 ms	5400	512K	2250
M4221AV	2.1 GB	SCSI	8.5 ms	7200	512K	975
M1936AV	3.6 GB	SCSI	11 ms	5400	512K	1275
M3243AV	4.3 GB	SCSI	8.5 ms	7200	512K	1425
M1991AV	9.0 GB	SCSI	11 ms	5400	512K	2265

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Prices are subject to drop-Please call for the most current pricing!!

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SyQuest

Capacity		Seek	RPM	Int.	Ext.
88 MB	SCSI	20ms	3200	300	360
200 MB	SCSI	18 ms	3200	410	470
270 MB	SCSI	13.5ms	3200	420	480
270 MB	IDE	13.5ms	3200	420	n/a

Cartridges

44 MB	SQ400	41
88 MB	SQ800	47
105 MB	SQ310	53
200 MB	SQ2000	75
270 MB	SQ327	63

One free cartridge with each SyQuest drive purchased

Network Cards & Hubs

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OEtherlinkII Coax/BNC 16 Bit ISA	138/168
EtherlinkIII BNC/Con 16 Bit ISA	110/125
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EtherlinkIII-20 BNC/Con 16 Bit ISA 20 pack	Call
EtherlinkIII Coax/BNC MCA	225
EtherlinkIII Coax/BNC 32 Bit EISA	225
EtherlinkIII BNC 16 Bit PCI	110
EtherlinkIII BNC & Con 16 Bit PCI combo	65

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CCIPS 10 Base T	268
CCIPS Combo 10 Base T & Coax	298
CCIPS Token Ring 10 Base T	454
Pocket III 10 Base T / Coax	268
Parallel Port Multiplexor adapt/cable	77

BOCA

BEN210 10 base T ethernet concentrator 8 port	135
BEN220 10 base T ethernet concentrator 16 port	265

Tape Backup Drives

Iomega

	Int	Ext
250 MB IDE Jumbo 250 QIC 80	$149	n/a
250 MB IDE Trekker 250 QIC 80 Parallel	n/a	275
350 MB IDE Jumbo 350 QIC 80	$189	n/a
350 MB IDE Trekker350 QIC 80 Parallel	n/a	285
700 MB IDE Trekker350 QIC 3010 Parallel	n/a	325
1.4 GB IDE Jumbo 1400 QIC 3010	$399	n/a
1.05 GB SCSI Powerjaz 1100 QIC525	$599	699

Hewlett Packard

2.0 GB 15MB/min 4mm media	$835	$885
3-5 GB 45MB/min 4mm media	995	1055
4-10 GB 60MB/min 4mm media	1225	1285
20-50 GB Auto Tape Loader HP1553 60MB/min 4mm media	3195	3295

CONNER

420 MB IDE Tapestor 420 15MB/min 4mm media	$165	n/a
850 MB IDE Tapestor 850 45MB/min 4mm media	$260	n/a

EXABYTE

2 GB SCSI 4200 26 MB/sec 8mm media	845	955
4 GB SCSI 4200 30MB/sec 8mm media	995	1095
2-5 GB SCSI 8200 30MB/sec 8mm cassette	1425	1495
7-14 GB SCSI 8505XL 60KB sec 8mm media	2250	2310

Mountain

250 MB TD250 QIC-80 IDE	155	n/a
305 MB MTN8500 QIC-80 IDE	310	n/a
700 MB TD700 QIC-80 IDE	475	n/a
1.0 GB MTN71000 4mm media SCSI	1675	1775
4.0 GB MTN1200 4mm media SCSI	1945	2045

Quantum DLT SCSI

Model	Capacity	Trans.Rate	Media	Price(Ext)
DLT2000X	30GB	2.5MB/sec	DLT20	5295
DLT4000	40GB	3MB/sec	DLT40	6295

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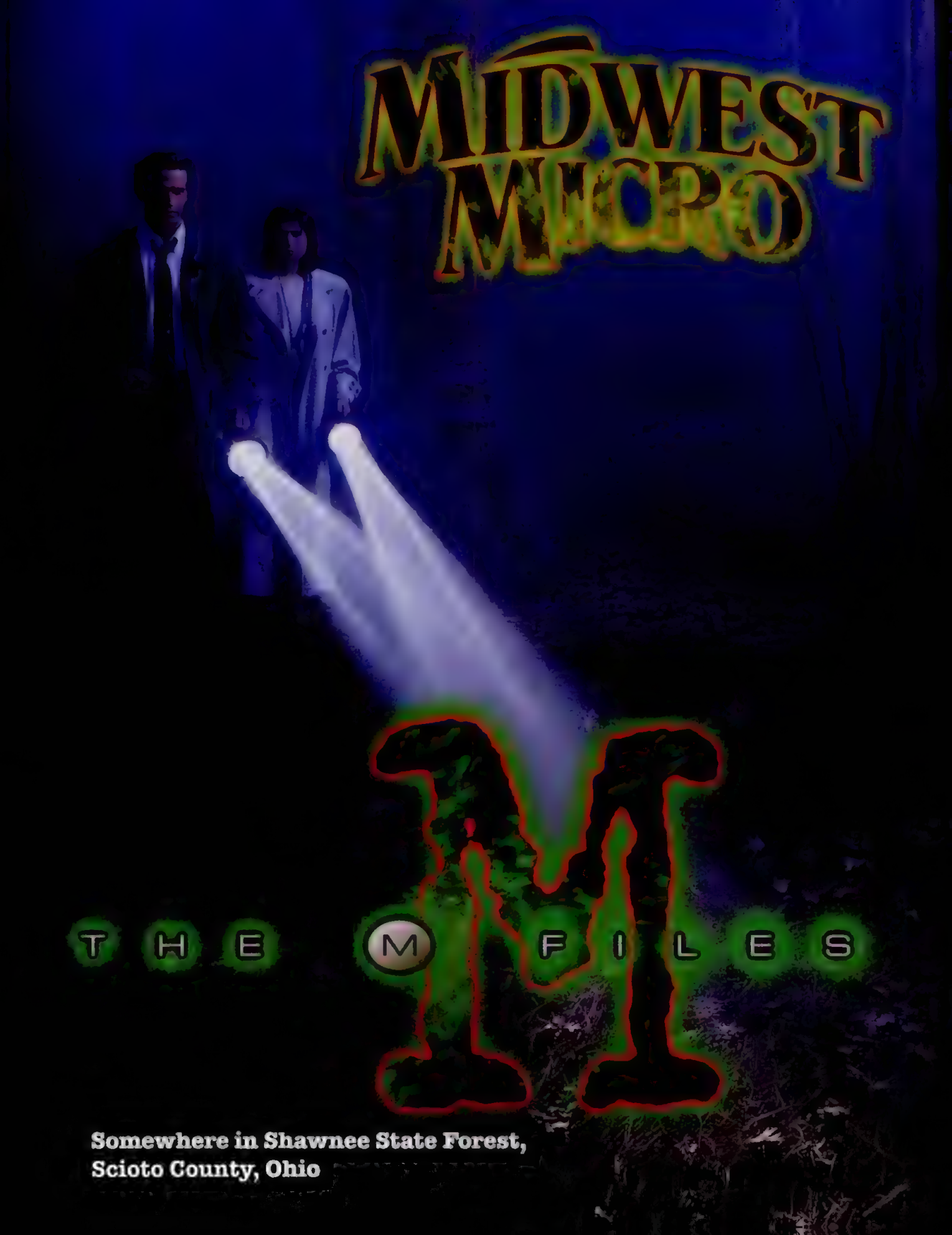
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- Signature 101-Key Enhanced Keyboard
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PC MAGAZINE EDITORS' CHOICE
May 30, 1995

If fast disk performance is what you're seeking, MidWest Micro systems race past the competition

System Description	Higher Score Represents Faster Performance (MidMark Architecture 2)
MidWest Micro P5-100 Office PC	**826**
Micron P100 Millennia	887
Gateway P5-100XL	788
ZEOS Pantera Pentium-100	753
USA Flex PT-100 Tower System	744

Source: PC Magazine "Tapping the Promise of the Pentiums" - May 30, 1995

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backpack Double Speed w/Sound, external	007288	379
backpack Quad Speed, external	005862	399
backpack Quad Speed w/Sound, external	007290	499

Panasonic

Double Speed, internal	003749	$171
Portable Double Speed	003728	239

Plextor

4PleX Quad Speed, internal	006721	$419
4PleX Quad Speed w/SCSI-2 Board, internal	006722	479
6PleX Six Speed, internal	006732	499
6PleX Six Speed w/SCSI-2 Board, internal	006733	549

Sony

2X Portable Discman	005431	$385
4X w/Kit, internal	005433	225

FAX MODEMS

Boca

14.4 V.32bis, external	002047	$195
14.4 V.32bis, internal	002045	79
14.4 Kbps w/VoiceView, internal	005211	125
28.8 V.34, external	002488	219
28.8 V.34, internal	002484	169
SoundExpression 14.4VSp Voice, internal	002164	169

Intel

14.4 Kbps, external	004765	$95
14.4 Kbps, internal	004766	89
14.4 Kbps w/Voicemail, external	003789	95
14.4 Kbps w/Voicemail, internal	005566	79
14.4 Kbps w/ Voicemail and Speakerphone, internal	005253	119
28.8 Kbps PCMCIA	005893	219
28.8 Kbps w/Voicemail, internal	005252	159
28.8 Kbps w/Voicemail and Speakerphone, internal	005249	199
28.8 Kbps V.34, external	003785	165
28.8 Kbps V.34, internal	005563	139

Megahertz

14.4 XJACK PCMCIA	005180	$199
14.4 XJACK Gold PCMCIA	005181	229
14.4 Fax Modem/PCMCIA Ethernet Adapter	005187	369
28.8 PCMCIA	003706	339
28.8 XJACK PCMCIA	003704	339

U.S. Robotics

Sportster 14,400 PCMCIA	003698	$179
Sportster 14,400 V.42bis, external	003687	115
Sportster 14,400 V.42bis, internal	003686	95
Sportster 28,800 V.34, external	003915	235
Sportster 28,800 V.34, internal	003916	219
Sportster 28,800 V.34 PCMCIA	003697	325
Sportster Si 14,400, external	003537	85
Sportster Si 14,400, internal	003536	69

HARD DRIVES

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540 Mb	004809	179
850 Mb	004825	219
1 Gb	004790	295
1.2 Gb	004826	309
1.6 Gb	005052	429

MONITORS

MAG

DX15F	004242	$365
DX17F	004231	629
LX1450LG	004228	245
MXP17F	004282	915
MX21F	004288	1995

NEC

MultiSync XE15	004644	$535
MultiSync XE17	004645	985
MultiSync XE21	004654	1795
MultiSync XV14	003565	309
MultiSync XV15	004824	429
MultiSync XV17	003566	745

Princeton Graphics

Ultra 14	006150	$195
Ultra 14nl	006151	239
Ultra 15	006152	335
Ultra 17	006153	995

Samsung

SyncMaster 3Ne	003854	$249
SyncMaster 15GLi	005274	469
SyncMaster 17GLi	005273	895
SyncMaster 17GLs	004599	829
SyncMaster 17GLsi	005272	995
SyncMaster 20GLs	004524	1325

Sony

Multiscan 15sf1	004742	$479
Multiscan 17se1	004743	1099
Multiscan 20se1	004744	1995
Trinitron CPD-1425	004847	395

ViewSonic

V14ES	006598	$275
V15GA	005737	499
V15GS	005736	419
V17	004132	829
V17GA	005739	935
V17GS	005738	745
V20PS	004805	1399
V21PS	004806	1699

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ACS51 Speakers	006712	$69
ACS52 Speakers	006713	99
ACS53 Speakers	006714	129
ACS300 3 Speakers	006704	299

Aztech

Sound Galaxy WaveRider 32 Sound Card	004827	$115

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Sound Blaster AWE32 Sound Card	005602	279
Sound Blaster AWE32 Value Edition Sound Card	005601	155
Sound Blaster CT-38 Speakers	005613	29
Sound Blaster Digital Schoolhouse Multimedia Kit	005603	225
Sound Blaster Discovery CD 4x Multimedia Kit	005605	345
Sound Blaster Discovery CD New Edition Multimedia Kit	005604	275
Sound Blaster Home 4x Multimedia Kit	005608	415
Sound Blaster SBS300 Speakers	005614	99
Sound Blaster Value CD Multimedia Kit	005620	195

Labtec

CS-150 Speakers	005100	$16.75
CS-180 Speakers	005101	21
CS-800 Speakers	005104	34

Media Vision

MV-2200 Quad-Speed Multimedia Kit	006964	$299
Pro Sonic 16 SCSI Sound Card	006958	69

Panasonic

EAB401P Speakers	001408	$45
EAB710P Speakers	001407	89

NETWORKING

3COM

EtherLink III Combo Adapter	006770	$119
EtherLink III Combo Adapter, 5-pack	006771	525
Fast EtherLink 10/100 BASE-T Adapter	006772	229
Fast EtherLink 10/100 BASE-T Adapter, 5-pack	006773	1115
LinkBuilder FMS 12-Port Hub	006774	639
LinkBuilder FMS 24-Port Hub	006775	1099

Artisoft

LANtastic Network Starter Kit	007180	$229
LANtastic v6.0 Software, 1 user	007181	79
LANtastic v6.0 Software, 5 user	007182	329

Boca

10 BASE-T Concentrator	002182	$125
BOCALANcard 2000+ Combo Adapter	005208	89
BOCALANcard 2000+ Combo Adapter, 5-pack	005244	299
BOCALANcard 2000T Adapter	005207	85
BOCALANcard 2000T Adapter, 5-pack	005243	279

Intel

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EtherExpress Pro/100 PCI Adapter	005164	249
EtherExpress XL Printer Server, BNC	002129	485

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10 BASE-T PCMCIA Adapter	005189	$149
Ethernet Combo PCMCIA Adapter	005190	179

PRINTERS

Brother

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HL-800	004676	679
HL-960	003468	899
MFC-4500ML	003469	999

Canon

BJ-30	003918	$255
BJ-100	002062	199
BJ-200ex	003897	229
BJC-70	003919	349
BJC-4000	003871	349
LBP-430W	003917	439

Epson

ActionLaser 1100	003867	$289
ActionLaser 1400	003971	499
LQ-300	002376	185
LQ-570+	002099	265
LQ-1070+	002105	415
LX-300	001575	179
Stylus Color	001936	529

Lexmark

2380 Plus Forms	001883	$299
2390 Plus Forms	002032	349
ExecJet IIc	001883	299
Optra R	006815	1449
Optra Rx	006808	2025
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Okidata

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ML521	006095	479
ML590	006098	419
ML591	006097	569
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OL410e	006081	535
OL410e/PS	002377	749

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KX-P1150	001672	$129
KX-P2023	001658	179
KX-P2130	001776	199
KX-P2135	001848	245
KX-P3626	003845	309
KX-P4400	001859	429
KX-P4430	001855	669
KX-P5400	001788	475

Hewlett Packard

DeskJet 320	004915	$395
DeskJet 540	004918	299
DeskJet 660C	004839	485
DeskJet 1200C	004837	999

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APC

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Back-UPS 450	000736	175
Back-UPS 600	001868	239
NET7 SurgeArrest	002191	29
NET7 SurgeArrest w/TEL	002192	45
Smart-UPS 700	006842	349
Smart-UPS w/s 650	006845	295

Tripp Lite

Isobar 4	001032	$39
Isobar 4	001165	49
BC Personal 280	005396	97
BC Personal 420	005397	135
BC Personal 500	005398	169
BC Pro 450 Network UPS	005399	149
BC Pro 550 Network UPS	005401	185
TR-6 Super Surge Alert	003783	29

SCANNERS

Canon

IX-3010	002718	$299
IX-4015	003089	725

Epson

ES-1000C	005263	$725
ES-1200C	003870	909
ES-1200C Pro	003872	1299

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Business Applications

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MS Excel 5.0, 3.5"	007558	279
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MS Works 3.0/Money, CD-ROM	007580	83

Graphics

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MS Publisher 2.0, CD-ROM	007582	84
MS Creative Writer, 3.5"	007583	31
MS Fine Artist, 3.5"	007577	39

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MS Ancient Lands 1.0, CD-ROM	007567	52
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MS Automap Road Atlas 4.0, CD-ROM	007592	37
MS Baseball '94, CD-ROM	007578	39
MS Cinemania '95, CD-ROM	007571	52
MS Dangerous Creatures 1.0, CD-ROM	007572	52
MS Dinosaurs, CD-ROM	007573	51

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MS Explorapedia Nature 1.0, CD-ROM	007567	32
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Jumbo 700, external	006035	339
Jumbo 700, internal	006048	189
Jumbo 1400, internal	004903	289
PowerTape 1100, internal	006026	815
PowerTape 2400, internal	006008	935
PowerTape 4000, internal	006010	1125

Iomega

Ditto 420, external	009704	$225
Ditto 420, internal	009703	115
Ditto 800 Travan, external	009706	305
Ditto 800 Travan, internal	009705	209
Ditto 3200 Travan, external	009708	499
Ditto 3200 Travan, internal	009707	299

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backpack 250/340 Mb, external	005859	$259
backpack 800 Mb Travan, external	005863	289
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GRAPHICS XPRESSION PCI, 1 Mb	004431	195
GRAPHICS XPRESSION VLB, 1 Mb	004430	195
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VIDEO-IT! VLB Capture Card	004952	245

Boca

Basic ISA, 256K	002016	$45
Super VGA ISA, 512K	001995	59
SuperX VGA ISA, 1 Mb	002167	109
Voyager 64 PCI, 2 Mb	005218	195

Diamond

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- Instant "ON" ready-to-work state – lasts for months on a charge
- [illegible]

Processor	Screen	HD	Price
486DX2/50	8.5" Dual Scan	260MB	$2549
486DX4/75	8.5" Dual Scan	260MB	3049
486DX4/75	9.5" Active	260MB	3649

HP OmniBook 5000

- Pentium 90MHz with 32-bit PCI Local bus
- Up to 1.2GB drives available for high capacity storage
- High resolution – 800x600 resolution on notebook display
- Built-in 16-bit sound, microphone & speaker

Processor	Screen	HD	Price
Pentium 90	10.4" Active	1.2GB	$5579
Pentium 90	10.4" Active	1.2GB	6239*

*16MB RAM standard

HP DeskJet 320 Printer

$299.99

Shown with optional feeder and color kit

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HP LaserJet 5P printer (IBM, 6ppm, 600dpi)	$879.99
HP LaserJet 5MP printer (IBM&MAC, 6ppm, 600dpi)	1039.99
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HP InkJet Printers

HP DeskJet 320 printer (portable)	$299.99
HP DeskJet 320 printer w/feeder	359.99
HP DeskWriter 320 printer (portable)	299.99
HP DeskWriter 320 printer w/feeder	359.99
HP DeskJet 540 printer	219.99
HP DeskWriter 540 printer	219.99
HP DeskJet 660C printer	389.99
HP DeskWriter 660C printer	389.99
HP DeskJet 1200C printer	979.99
HP DeskJet 1200C/PS printer	1589.99
HP DeskJet 1600C printer	1349.99
HP DeskJet 1600CM printer	1989.99

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HP OfficeJet	$689.99
HP FAX-700	549.99

HP Scanners

HP ScanJet 3P (grayscale)	$319.99
HP ScanJet 3C (color)	949.99

HP (Colorado) Tape Drives

Trakker 350MB (portable)	$269.99
Trakker 700MB (portable)	339.99
Jumbo 350MB (internal)	139.99
Jumbo 700MB (internal)	199.99
Jumbo 1400, 1.36GB (internal)	369.99
T1000, 800MB (internal)	189.99

IBM®

Additional Products from IBM®

Processor	Screen	HD	Price
ThinkPad® 755 Pentiums Now Available!			
486DX4/100	10.4" Dual Scan	340MB	$3499
486DX4/100	10.4" Dual Scan	540MB	3849
486DX4/100	10.4" Dual Scan	810MB	4299
486DX4/100	10.4" Active	340MB	4299
486DX4/100	10.4" Active	540MB	4649
486DX4/100	10.4" Active	810MB	5099
486DX4/100	10.4" Active	540MB	5649*
486DX4/100	10.4" Active	810MB	6099*
Pentium 75	10.4" Active	540MB	4749+
Pentium 75	10.4" Active	810MB	5199+
Pentium 75	10.4" Active	540MB	5799
Pentium 75	10.4" Active	810MB	6249

*Features built-in CD-ROM drive

† Does not include built-in modem, audio or telephony

Processor	Screen	HD	Price
ThinkPad® 755CV			
486DX4/100	10.4" Active LCD	540MB	$6099
486DX4/100	10.4" Active LCD	540MB	7099*
486DX4/100	10.4" Active LCD	810MB	7549*

*Features Built-In CD-ROM drive

ThinkPad® 755CV with built-in overhead projection panel

ThinkPad® 701

ThinkPad® 701

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- Built-in 16-bit sound, microphone, speaker & MIDI
- Built-in infrared for no hassle printer connections
- 20 **FREE** software titles preinstalled

Processor	Screen	HD	Price
486DX2/50	10.4" Active	360MB	$3699
486DX2/50	10.4" Active	540MB	4049
486DX4/75	10.4" Dual Scan	360MB	3549
486DX4/75	10.4" Dual Scan	540MB	3849
486DX4/75	10.4" Active	360MB	4299
486DX4/75	10.4" Active	540MB	4599

COMPAQ

Contura 410

Product differs slightly from photo.

Contura 420/430

- 10.4" Active & Dual Scan
- Fast 486DX4/75 or 486DX4/100 processors
- Optical trackball – smoother & more reliable
- High capacity drives – up to 720MB
- Compaq, 3-year worldwide warranty

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	420MB	$2459
486DX4/75	10.4" Active	420MB	3029
486DX4/100	10.4" Dual Scan	720MB	2839
486DX4/100	10.4" Active	720MB	3499

ProLinea

ProLinea

- PCI Local bus – high speed graphics
- PCI IDE controller – fast disk drive performance
- Compaq, 3-year worldwide warranty w/ 1st year on-site

Chassis	Processor	HD	Price
Desktop	486DX2/50	270MB	$1129
Desktop	486DX2/66	420MB	1529
Desktop	486DX4/100	420MB	1719
Minitower	Pentium 75	720MB	2399

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Pentium 75 Built-in 4X CD-ROM

Satellite Pro T400

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- Built-in 16-bit sound, microphone, speaker & MIDI
- 10.4" Active & Dual Scan
- Built-in AC adapter - small, sleek design & reduced weight
- Integrated Accupoint - small, accurate & easy to use
- Lithium-Ion battery technology
- Built-in Infrared for hassle-pointer connections

Processor	Screen	HD	Price
Pentium 75MHz	10.4" Dual Scan	810MB	$3969
Pentium 75MHz	10.4" Active	810MB	4799

Satellite Pro T400

Portégé 610CT

Processor	Screen	HD	Price
Pentium 90MHz	9.5" True Color	720MB	$4359

90MHz Pentium

610CT

NEW!

T2120

Satellite T2110/T2130

- 10.4" Dual Scan & Active
- Built-in AC adapter - small, sleek design & reduced weight
- Integrated Accupoint - small, accurate & easy to use

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	320MB	$2199
486DX4/75	10.4" Dual Scan	500MB	2549
486DX4/75	10.4" Active	500MB	3059

Additional Toshiba Notebooks

T4900

Processor	Screen	HD	Price
T4900CT			
Pentium 75	10.4" Active	772MB	$4799
T4850CT			
486DX4/75	10.4" Active	772MB	$3349
Satellite T2100			
486DX2/50	9.5" Mono	250MB	$1299
486DX2/50	10.4" Dual Scan	330MB	1999
486DX2/50	8.4" Active	330MB	2699
Satellite T2150			
486DX4/75	10.4" Dual Scan	500MB	$2999
486DX4/75	10.4" Active	500MB	3699

PCM 9 95

NEC

Call about the NEW Versa 4000

Additional NEC Notebooks

Processor	Screen	HD	Price
Versa P			
Pentium 75	9.5" Active	340MB	$4069
Pentium 75	9.5" Active	540MB	4349
Pentium 75	9.5" Active	810MB	4729
Pentium 75	9.5" High Res.	540MB	4539
Pentium 75	9.5" High Res.	810MB	4899
Pentium 75	10.4" Active	540MB	4629
Pentium 75	10.4" Active	810MB	4999
Pentium 75	10.4" High Res.	810MB	5199
Versa M			
486DX4/75	9.5" Dual Scan	250MB	$2369
486DX4/75	9.5" Dual Scan	340MB	2459
486DX4/75	9.5" Active	340MB	2739
486DX4/75	9.5" Active	540MB	3029
486DX4/75	9.5" High Res.	540MB	3199
486DX4/100	9.5" Active	340MB	3399
486DX4/100	9.5" Active	810MB	4069
486DX4/100	9.5" High Res.	540MB	3879
486DX4/100	9.5" High Res.	810MB	4249

Versa 2000

Versa 2000

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- VersaGlide touch-pad pointer - simple & accurate
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- LOADS of FREE software preinstalled

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	350MB	$1899
486DX4/75	9.5" Active	350MB	2299*
486DX4/75	9.5" Active	350MB	2599
486DX4/75	9.5" Active	540MB	2799

*14.4 fax/modem not built-in

TEXAS INSTRUMENTS

TravelMate 4000M

75MHz Pentium with PCI BUS

TravelMate 5000

TravelMate 4000M

- NEW Large displays - 10.4" Active 10.5" Dual Scan
- Brilliant color display
- 16-bit sound card
- Integrated pointing device
- 2 Type II or 1 Type III PCMCIA slot

All New Models

Processor	Screen	HD	Price
486DX4/75	10.5" Dual Scan	455MB	$2459
486DX4/75	10.4" Active	525MB	2799
486DX4/100	10.4" Active	525MB	3479

TM4000M CD-ROM Docking Station: $809.99

TravelMate 5000

- 75MHz Pentium with PCI Bus to optimize Pentium processor performance
- 10.4" Active Matrix display with 2MB Video RAM
- 10.5" Dual Scan display with 2MB Video RAM
- 65k colors on notebook display
- 16-bit Sound Card, Speaker, Microphone & MIDI
- Upgradable hard drive - easily add more storage
- Built-In Dual Lithium Ion Batteries
- Built-in Infrared for no-hassle pointer connections

Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	500MB	$3899
Pentium 75	10.4" Active	772MB	4599

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646-647

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CFA540A	540MB	11MS	3.5" IDE	168
CFA850A	850MB	10MS	3.5" IDE	219
CFA1275	1.27GB	10MS	3.5" IDE	319

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CFP1060S	1.06GB	9MS	3.5" SCSI	$479
CFP1080S	1080MB	11MS	3.5" SCSI	434
CFP2105S	2147MB	8.5MS	3.5" SCSI	839
CFP2107S	2147MB	8.5MS	3.5" SCSI	981

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ST5850A	850MB	12MS	3.5" IDE	235
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SCSI DRIVES

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AC2540	540MB	12MS	3.5" IDE	222
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AC31200	1.2GB	10MS	3.5" IDE	329

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LT540A	541MB	11MS	3.5" IDE	214
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SCSI DRIVES

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IMP1080S	1080MB	9MS	3.5" SCSI	534
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IMP2160S	2160MB	9.5MS	3.5" SCSI	849
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MC1991	9100MB	12MS	5.25" SCSI	2124

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MC1991W	9100MB	12MS	5.25" SCSI	2349

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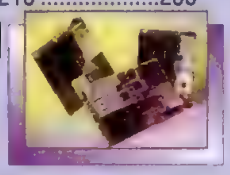

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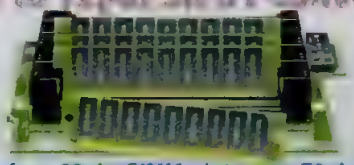

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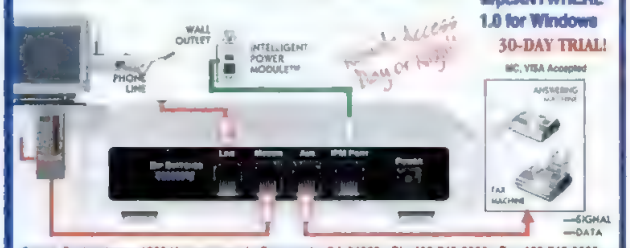

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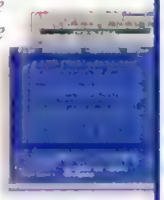

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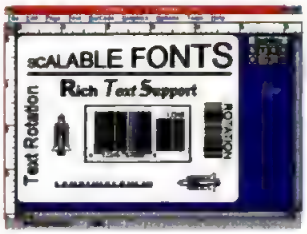

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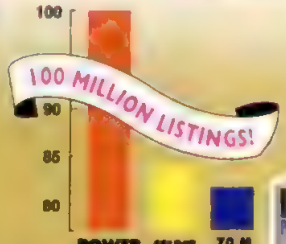

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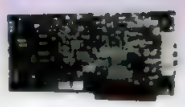

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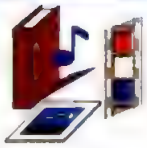

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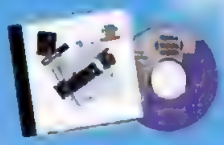

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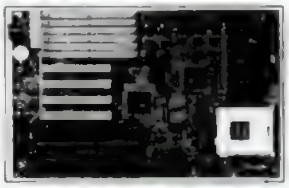

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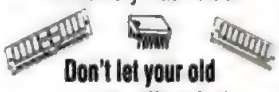

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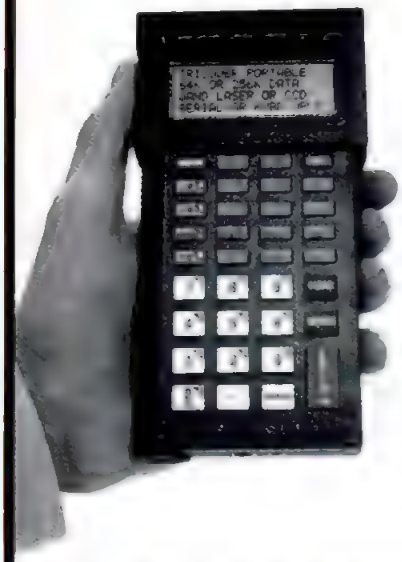

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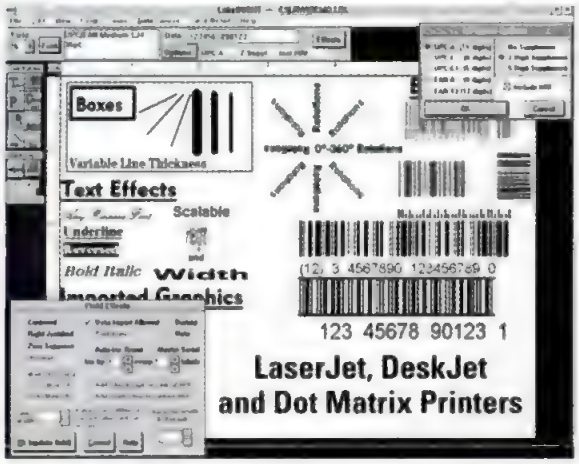

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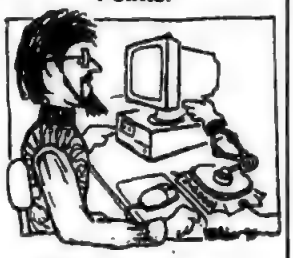

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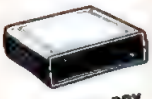
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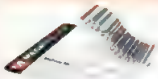

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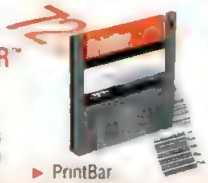

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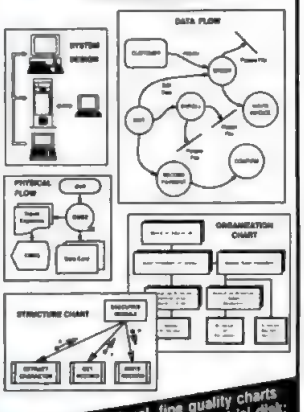

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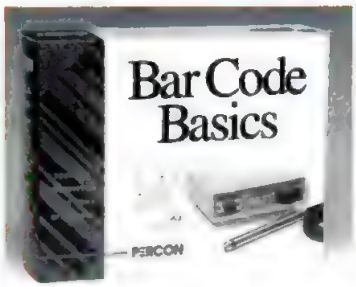

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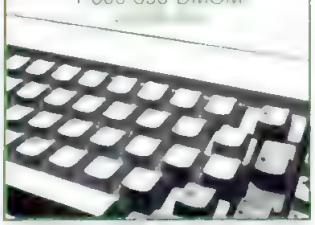

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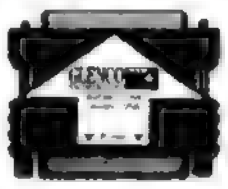

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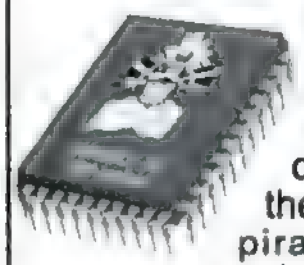

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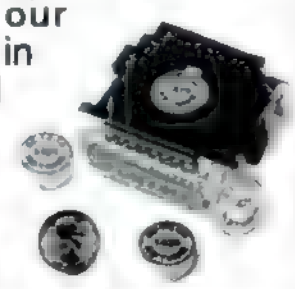

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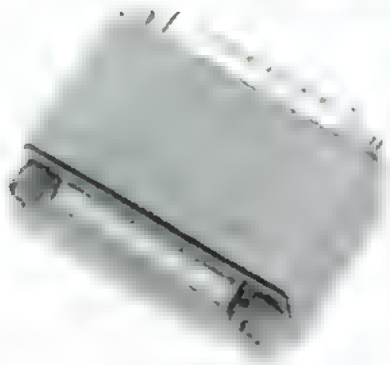

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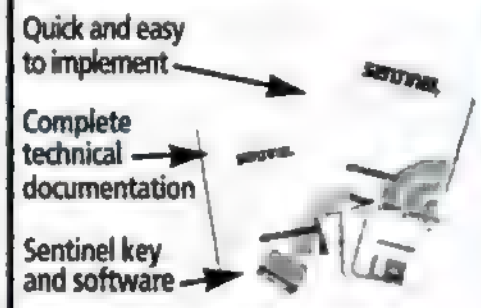

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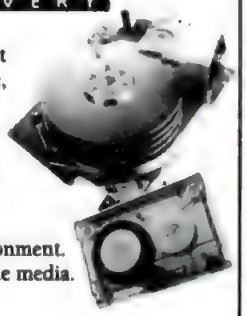

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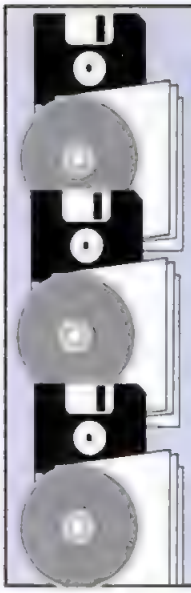

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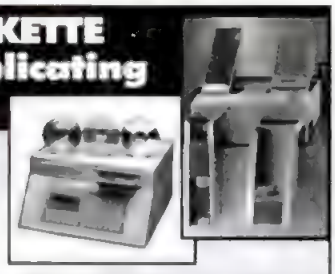

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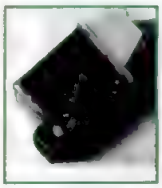

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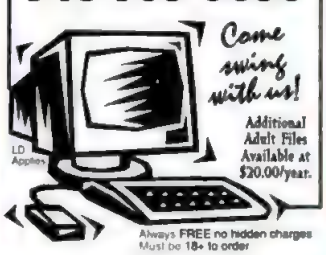

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Coming Up

Picking Your Next OS

Your next operating system will be a 32-bit, multitasking, multithreaded platform with a sophisticated object-oriented shell, built-in networking, and backward compatibility with Microsoft Windows 3.1. But will it be Microsoft Windows 95, Microsoft Windows NT, or IBM's OS/2 Warp? We take a close look at these three hot new releases. Which handle single-tasking and multitasking workloads best? Which are the most robust and stable under stress? What sort of hardware do you need to run them? We give you answers based on exhaustive tests that cover performance, capacity, compatibility, and crashability across a variety of current hardware platforms and peripherals. We also take a comparative look at each environment's features, interface, architecture, networking capabilities, and bundled applications.

High-Performance Pentiums

Processor performance continues to ratchet upward, with the newly released 120- and 133-MHz Pentium CPUs eclipsing the power of now-pedestrian Pentium/100s. And the good news is that systems built around these speedy new chips don't cost as much as you might expect. PC Magazine Labs tests more than 70 machines based on the fastest Pentium processors you can find on the market today.

50 Reasons to Go Back to School

Whether your youngsters are preschool or premed, *PC Magazine* can help you choose the right products to help them earn straight A's. We look at 50 programs that can assist with everything from learning the alphabet to mastering human anatomy. We also tell you which PC a student should be taking back to campus.

PC Databases as Query Tools

As PC databases have grown in power and sophistication, they have learned many tricks from industrial-strength corporate database systems. One of the most impressive is their ability to query SQL client/server data. But how far can PC databases take you when used as SQL query tools? Can they rival dedicated packages? If your company has already deployed a PC database as part of an application suite, it may be sitting on a significant untapped resource. PC Tech also looks at how to stay out of trouble when using Windows 95 long filenames in a mixed-networked environment. Finally, we explain how Satan and Courtney can make your Internet servers safer from outside attacks.

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NoteJet II 486C	KT315477	$169	KT315478	$333	N/A	N/A
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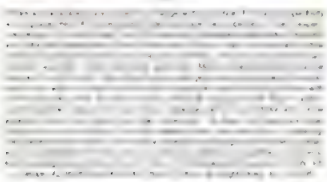

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DOS Windows CD-ROM Resource-Intensive Adult Content Kids (Ages) Price

Recording Your Family's History

In the beginning, family histories were passed down by word-of-mouth anecdotes and charcoal drawings on cave walls. Today, though, the family saga is as likely to be told in video as it is in simple words, pictures, and trees.

Enter the latest generation of family history software. These four programs all allow you to compile and save family records, dates, documents, photographs, and even oral histories. Three of the programs, Family Tree Maker, Expert Personal Roots, and Family Ties for Windows use a family tree model for organizing your family history. The fourth program, Echo Lake, lets you compose multimedia books that comprise your family's stories.

Echo Lake

Delrina Software Inc.; 408 363-2345.

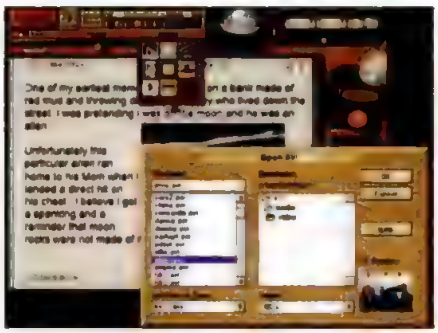
Circle 474 on reader service card

★★★★ $69.95

Think of Echo Lake not as a genealogist but as a family historian. It's a multimedia diary that allows you to record the dates, events, stories, sights, and sounds that serve as milestones in your life.

This unique approach to family record-keeping starts with the social interface, a 3-D point-and-click environment that's reminiscent of something you would find in an adventure game. In this case the setting is a log cabin in the woods, within which you'll find the study that serves as your creative space.

To tell your story, you'll need to create a book, which will be stored on the shelves of that cabin. Your book can contain as many stories as you like—your earliest memories of throwing dirt clods at a neighbor, your first date—told in words and multimedia. Others may read and update a book, or it can be password-protected.



Echo Lake lets you enrich the important stories of your life with multimedia.

You can illustrate stories with photos, enhance them with narration or music, and provide a historical backdrop by adding a video clip. For example, you might want to add a video clip of Neil Armstrong's moon walk to your reminiscence of watching that historic event on your family's first color television. The program allows you to import multimedia elements in all the standard formats, so you're not limited to the included libraries.

For those who find it tough to get started, Echo Lake includes the Inspirator, a spreadsheet that places the chronology of your life in one column and topics such as friends, homes, education, and career across the top row. You can, for example, record the places you lived during each year of your life, then see what stories this list stirs up.

When you're satisfied with your compilation, you can print it in book format (sans video and sound) or save the whole production to disk in runtime form so that any PC user can enjoy it.

Echo Lake is a must-have for anyone with tales to tell and memories to save.

Family Tree Maker Deluxe CD-ROM Edition

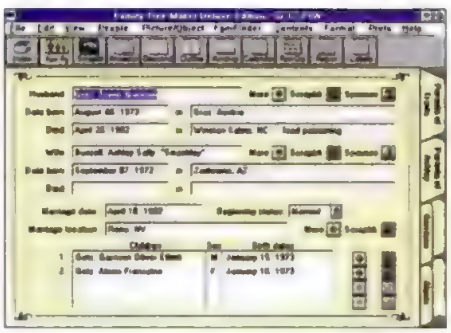
Banner Blue Software; 510-794-6850.

Circle 475 on reader service card

★★★★ $80

As its name suggests, the focus of Family Tree Maker Deluxe CD-ROM Edition is composing your family tree. The program offers an easy-to-use method of accomplishing this task, and it also provides tools to do quite a bit more.

When you start the program, you're faced with a Family Page that has spaces for entering names, birth dates and places, and relationships. Each Family Page holds information on two generations; you can add Pages for



Family Tree Maker provides everything you need to create a full family tree.

AFTER HOURS INDEX

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up to 2 million relatives.

Each individual in your family tree has a More About section and a scrapbook. The More About section allows you to record facts, stories, and medical history. In the scrapbook you can add scanned photos and documents, and video and sound clips.

If you're missing information on your ancestors, Family Tree Maker can help you track it down. The Deluxe CD-ROM Edition includes the Family Finder Index, which serves as an index to government record indexes. It includes more than 150 million names and the name of the index where you can find information on specific individuals. The one drawback is that it's not integrated into the Family Tree portion of the package. Look for the next version of the product, which should be available this fall, to include more records and to be integrated directly into the rest of the program.

When you're satisfied with your family tree, you can choose to print it in a variety of ways. Printing is both easy to do and rewarding.

Expert Personal Roots

Expert Software Inc.; 305-567-9990.

Circle 476 on reader service card

★★★ WIN $14.95

Expert Personal Roots provides an inexpensive way to begin growing your family tree. It lacks some of the bells and whistles of the more expensive programs, but it has all the basic features you need.

Family Tree Maker, Personal Roots starts the tree-making process with a series of data entry fields for entering names, places, and dates. The software does some data-verification while you type; for example, it won't let you enter a date out of range or a death date that's earlier than a birth date. But it does not check whether names and places are spelled consistently.

Personal Roots allows you to attach free-form notes to an individual's record and to link a single .BMP photo to the record. It can't import any other photo formats, nor does it accept video or sound clips. And there are no photo-editing or -viewing capabilities.

Like all of these programs, though, Personal Roots does provide a number of ways to print and display your data. In addition to the standard ancestor and descendant trees, you can generate personal data sheets, a family album, an alphabetical list, calendars, mailing labels, missing-information reports, and reports by birth, wedding, or death dates. Data can be exported in the GEDCOM format, which all these genealogy programs recognize.

Personal Roots is easy to use and should prove adequate for those more interested in a tree than a multimedia family history.

Expert Personal Roots isn't fancy but can help you organize your family.

Family Ties for Windows

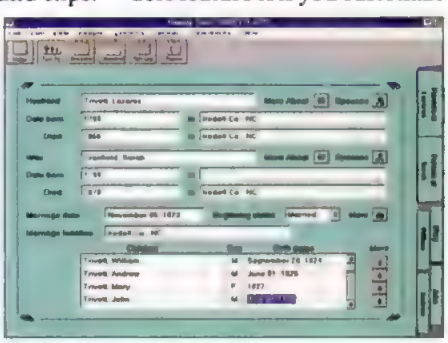
Individual Software Inc.; 800-822-3522.

Circle 478 on reader service card

★★ WIN $24.95

Family Ties for Windows differs from the other family history programs in this review in that it handles text only. Its tree generating is also more limited than what the other programs offer.

Family Ties provides dialog boxes in which you may enter name, birth, marriage, and death data. The family tree can hold only 2,000 individuals, however. When it's time to display and print your family record, you can choose to create family, ancestor, descendant, or group trees, as well as an index or a report. The printed reports are particularly attractive, and a fonts and borders feature lets you customize and decorate output.



Family Ties for Windows allows you to document your family history in text only.

The biggest drawback to Family Ties is that it cannot attach any kind of artwork to your documents. The company is working on a new version that will add this capability.

—Donald B. Trivette

Vietnam

CD-ROM PICK HIT

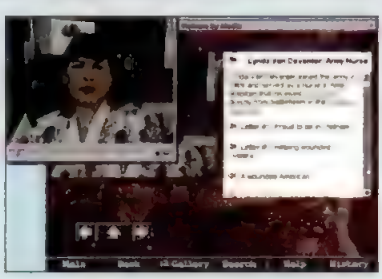
The Vietnam era was a defining event in the lives of baby boomers. Medio Multimedia capitalizes on this in an ambitiously researched chronicle of America's longest war. Vietnam the CD-ROM blends original video, hyperlinks to leading books on the subject, maps, time lines, and photographs. But most notably, the crisp presentation fairly represents the spectrum of opinion through interviews with and coverage of then-contemporary politicians, military leaders and line soldiers, peace activists, and ordinary citizens here and in Vietnam. If the Vietnam War impacted your life or that of a loved one, this is a must-explore CD-ROM.—J.W. Olsen

Medio Multimedia; 206-867-5500.

Circle 477 on reader service card

★★★★ WIN

$59.95



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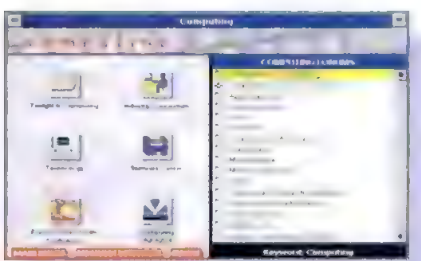

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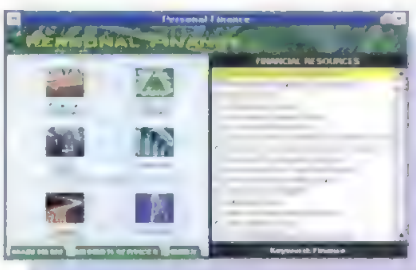

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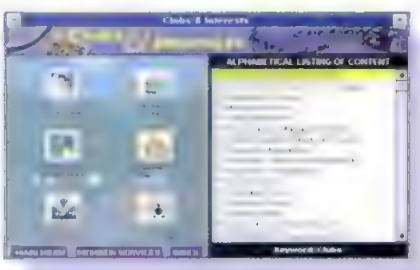

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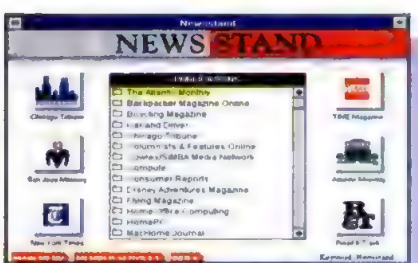

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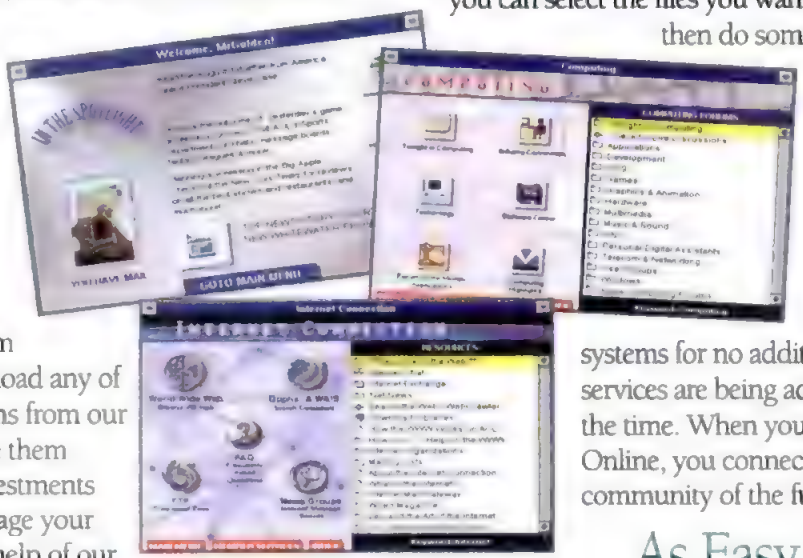

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Kids

What Is a Family Anyway?

Kids' Family Tree
Virtual Entertainment; 617-449-7567.
Circle 479 on reader service card
★★ WIN 4.0 $14.95

Even the littlest genealogist can chart her family history with Kids' Family Tree. This program proposes to teach kids all about families—from how they're formed to how every family is unique and to the relationships among family members. This is an ambitious goal that Kids' Family Tree doesn't quite meet.

This is a modest program with interesting if not particularly deep content. As is typical of most children's software, Kids' Family Tree offers a point-and-click interface that incorporates a few hot-spot animations. The interface is not as intuitive as it could be, though, and Albert (your guide to the program) remains mute when he should be offering navigational assistance.

At the heart of the program lies The Family Tree. Inside you'll find a Discovery Room filled with animated books that explain the nature of families, an Experiment Room where you can create a family tree using cartoon drawings as illustrations, a Fun Fact book that list facts about families, and a Build-A-Family Game.

Kids at the upper limits of the program's 4-to-10 age range are likely to find the ac-

QUICK CLIPS

Recommended · It's Your Call · Not Recommended

The Holocaust

Graphic images of man's inhumanity are presented with no sensitivity or sense of context. This important subject truly deserves better treatment than it gets on this CD-ROM. *$39.99; Quanta Press Inc.; 612-379-3956.*

Jigsaw-It!

There's a lot to be said for electronic puzzles that let you endlessly take apart your family (or any other digital image) and put it back together again. But you may not think this privilege is worth the steep price of this CD-ROM. *$58; Dynaware USA Inc.; 800-280-6108.*

Looney Tunes Animated Screen Saver

What's up, Doc? Here are 12 screen savers starring Bugs Bunny to turn even Monday afternoon into Saturday morning on your PC. *$29.99; Berkeley Systems; 510-540-5535.*

World of Illusion

Do you believe in magic? You will after mastering the many coin tricks, rope tricks, and other illusions this multimedia program teaches. Just don't get carried away and make the CD-ROM disappear. *$29.95; Alan Rand Multimedia Group; 800-298-1386.*

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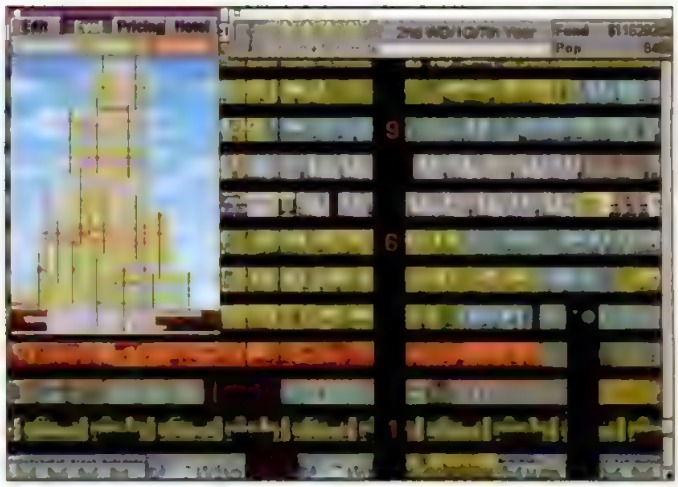
Kids' Family Tree lets kids choose faces for their family members.



SimTower lets you Sim fans try your hand at skyscraper building.

tivities too simplistic to be involving for long. Kids at the younger end of the age range are likely to have a hard time figuring out how to work the program and may well be disappointed that not every mouse click is rewarded with a witty animation.

Still, Kids' Family Tree tackles an important subject in a sensitive manner—it just needs to work on the presentation of its material a bit more.—*Gayle C. Ehrenman*

Simulations

SimCity Goes Vertical

SimTower

Maxis; 800-336-2947.

Circle 480 on reader service card

★★★ WIN $39.95

Your goal is to build a skyscraper, make it grow big enough to be labeled a 5 Star Tower, and finally crown your 8th Wonder of the Modern World with a cathedral. But erecting a tower takes a lot more than steel beams and foul-mouthed construction workers.

In addition to building offices, condos, and parking garages, you have to worry about eating facilities, fire, and the occasional bomb threat. You also have to make sure your SimTenants can get around your tower. If they have to wait too long for the elevators, they'll move to the better-managed SimTower down the street. You can keep track of these tenants, name them, monitor their stress levels, and locate their exact whereabouts.

All this voyeurism requires heavy system resources; on a 486/33 with 8MB of RAM, it took more than 30 minutes for 12 SimHours to pass in Fast Mode. But this annoying foible aside, SimTower is ideal for any SimFan who aspires to be another SimTrump.

—*Shane Mooney*

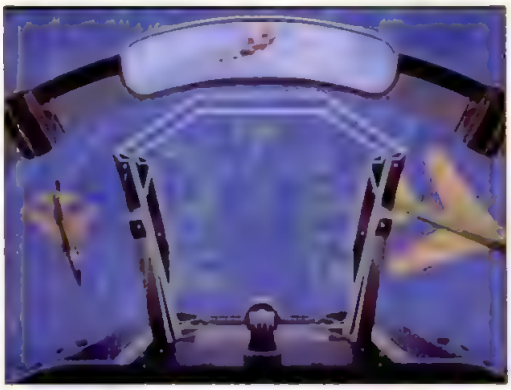
SPOTLIGHT ON ACTION

U.S. Navy Fighters

U.S. Navy Fighters is the best-looking flight simulator on the market, bar none, and offers some of the most intense air combat action ever to grace a PC screen. It's also the perfect game for armchair pilots frustrated by Spectrum Holobyte's Falcon and other, more difficult flight sims.

The story involves a war between Russia and Ukraine. You can fly 40 intricate and varied missions, including both air-to-air and attack sorties, in the U.S. effort to aid Ukraine. You can also create your own missions using the built-in mission editors.

After a video briefing and a few preflight option screens, you're cleared for takeoff. You can fly several types of aircraft, including the F-14B Tomcat, F/A-18C Hornet, and F-22 Lightning II. It's fairly easy to get the hang of flying and fighting, thanks to an array of difficulty settings. Especially helpful is the autopilot, which lets you avoid the white-knuckled terror of carrier landings. While in flight, listen to your wingmen: The realistic, amusing, and sometimes raunchy radio chatter can often help you stay alive. Your computer opponents are intelligent and crafty, making dogfights challenging. Even so, flight-sim purists may find the action a bit simplistic.



You can play the game in resolutions up to 1,024-by-768, although you'll need some serious hardware to do so. On a 90-MHz Pentium, the 800-by-600 mode with textures turned off seems to offer the best mixture of frame rate and resolution.—*Michael Ryan*

Electronic Arts; 415-571-7171.

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★★★★ CD-ROM $59.95

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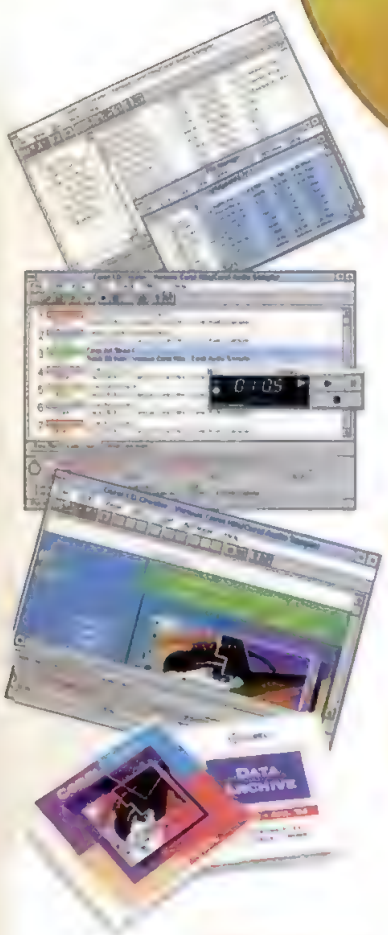

1. To design the layout of the information simply drag and drop data and audio files directly to the Corel CD Creator window.

2. Using a CD recorder you can now "burn" your CD.

3. Create your own jewel case insert or use the sample templates provided.

Corel CD Creator was designed with you in mind—it's an easy, affordable and comprehensive program that lets you create CDs effortlessly. Ideal for professionals and beginners alike, the Disc Wizard included with the program will make CD recording a simple and familiar process for any user.

Corel CD Creator provides a secure and durable medium for storing your vital data with quick and easy access. The CDs you create can then be played on virtually every CD-ROM drive or audio player—making Corel CD Creator the most user-friendly CD recording software on the market!

"Corel CD Creator is definitely king of the mountain... it won our Best of Times award."
LAN Times
January, 1995

"The genius of CD Creator is that it hides the complexity and makes creating your own CD-ROMs a familiar process."
PC Magazine
February, 1995

"Simply the best CD authoring package available."
PC Pro
February, 1995

Features:

- Create mixed mode discs (audio and data)
- "Drag and drop" layout design using OLE 2.0
- Support for single session and multisession discs
- Writes MS-DOS or ISO-9660 file names
- Includes a WAV file editor
- Create your own customized CD jewel case insert
- Includes a utility to create your own compilation Photo CD

Did you know...?

CD recorders can be purchased for as little as $1500*!

Corel CD Creator works with virtually all CD recorders
To create your own CDs, you will also require a CD recorder
For a complete list of Corel certified recorders, please call:
1-613-728-0826 ext. 3080, Document # 1010

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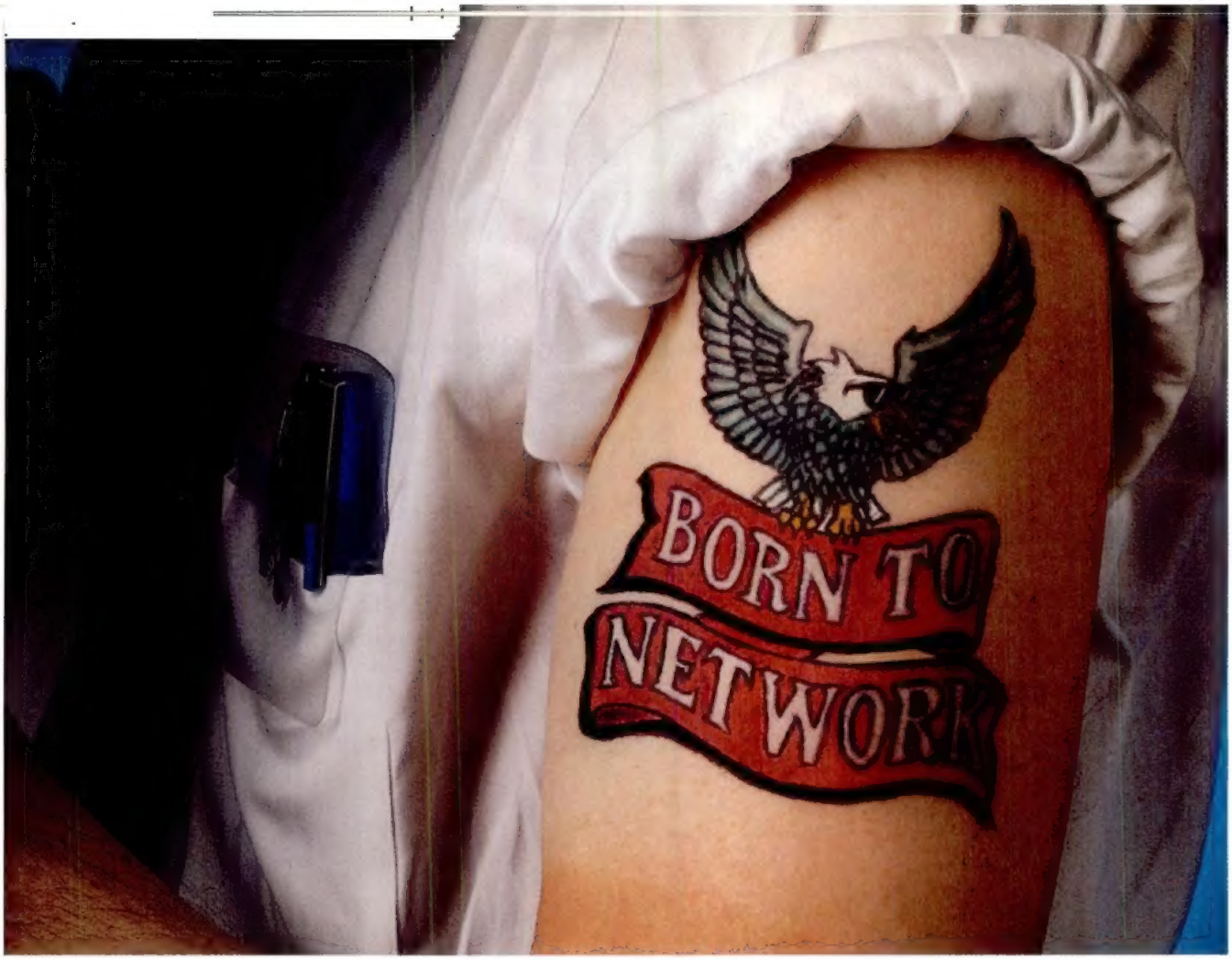

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

From the Shareware Catalog

"**DISNEY95.ZIP** (214397 bytes) download time (19200 baud), 2 minutes. Required equipment: VGA Graphics, Mouse recommended."—*COMPUTER CURRENTS*

Emu to You, Too

We'd like to thank the 120 readers who sent letters explaining why an emu might be "microchipped" (see Abort, Retry, Fail?, May 30, 1995). Todd Taylor even sent in this photo of the kind of gizmo that breeders implant in their valuable livestock for identification purposes.

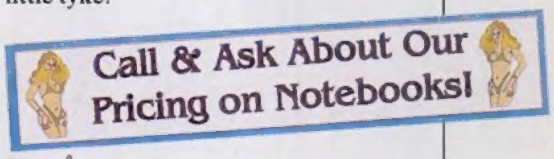
Makes You Wonder What Your Old 286 Is Worth

"For sale: CRAY X-MP Supercomputer. 5 years old, original cost $12 million. With all support equipment, ready to use. Asking $30,000 or best offer." —*ATLANTA JOURNAL AND CONSTITUTION*

One jiggle of the handle, and whatever's on-screen swirls down Latrina's toilet—with audio accompaniment, of course. Also available, a TNT detonator. Both connect via the keyboard port. (Creative Insights, $39.95.)

Kute Komputer Kiddies

John-Austin, son of faithful reader Jay Bergman, had a kindergarten homework assignment: Name something that flies. "Batman," he told his dad. What else? "Superman," he said. "Anything else?" Dad asked. "Toasters!" said the little tyke.



And the Appalling Clip Art of the Month award goes to. . .N2 Computers of Dallas, Texas.

Wouldn't want Europeans to have to guess what's inside this box!

Richard Tennant

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Jay Bergman, Fred Boness, Dan De Guire, Harold McFarland, David Price, and Todd Taylor.

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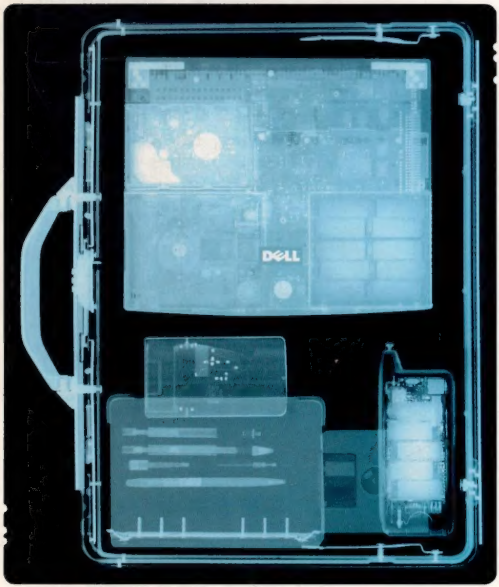

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intel inside pentium processor

Dell's featured digital artist is Sanjay Kothari of New York, NY.